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MULTAN, D.G KHAN, BAHAWALPUR, SAHIWAL (SOLVED PAPERS)

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# GHAZALI

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with Complete Solution

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10

- ☐ Chapter Wise Self Test System
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## Chapter 9 Chemical Equilibrium

All Punjab Past Board Papers  
2014 - 2021

## ALP Annual Paper 2021

## MCQ's

- The color of HI is: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-I, SWL-II)  
(A) Orange (B) Purple (C) Colourless (D) Red
- The expression for the equilibrium constant for the reaction:  
 $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$  is (RWP-II, SGD-I/II, DGK-II, SWL-II)  
(A)  $\frac{[NH_3]^2}{[N_2][H_2]^3}$  (B)  $\frac{[N_2][H_2]^3}{[NH_3]^2}$  (C)  $\frac{[NH_3]}{[N_2][H_2]}$  (D)  $\frac{[NH_3]}{[N_2][H_2]^3}$
- Molar concentration is expressed as: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-I, SWL-II)  
(A) { } (B) ( ) (C) [ ] (D)  $\emptyset$
- At equilibrium state the value of  $K_c$  is equal to: (BWP-II, LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
(A)  $\frac{K_r}{K_f}$  (B)  $\frac{K_f}{K_r}$  (C)  $\frac{K_r}{R_r}$  (D)  $\frac{R_f}{R_r}$
- What are units of  $K_c$  for the reaction?  $H_2 + I_2 \rightleftharpoons 2HI$  (RWP-II, GUJ-I, II, SWL-II, DK-II)  
(A) no units (B)  $\text{mol dm}^{-3}$  (C)  $\text{mol}^2 \text{dm}^6$  (D)  $\text{mol}^{-1} \text{dm}^3$
- The value of  $K_c$  depends only on: (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Temperature (B) Initial concentration  
(C) Pressure (D) None of these
- In chemical reaction, the substance that combine are called: (BWP-I)  
(A) Product (B) Reactants (C) Mass (D) Material
- The colour of iodine is: (MLT-I)  
(A) Red (B) Black (C) Purple (D) Colourless

2014 - 2020

## 9.1

## Reversible Reaction and Dynamic Equilibrium

- When  $CaCO_3$  is heated in an open flask, it decomposes to form calcium oxide (CaO) and \_\_\_\_\_. (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
(A)  $O_2$  (B) CO (C)  $CO_2$  (D)  $CO_3$
- Such reactions which continue in both directions are called: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Irreversible (B) Reversible  
(C) Non-reactive (D) Dynamic equilibrium
- Forward reaction represented as: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
(A)  $\longrightarrow$  (B)  $\longrightarrow$  (C)  $\longleftarrow$  (D)  $\rightleftharpoons$



12. When reaction ceases to proceed, it is called:

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

- (A) Dynamic Equilibrium  
(C) Physical Equilibrium

- (B) Chemical Equilibrium  
(D) Static Equilibrium

13. A reaction in which products recombine to form reactants is called:

(SGD-I/II, DGK-II, SWL-II)

- (A) Reversible reaction  
(C) Forward reaction

- (B) Irreversible reaction  
(D) Backward reaction

14. \_\_\_\_\_ reaction is irreversible:

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

- (A)  $N_2 + 3H_2 \longrightarrow 2NH_3$   
(C)  $2H_2 + O_2 \longrightarrow 2H_2O$

- (B)  $N_2 + O_2 \longrightarrow 2NO$   
(D)  $H_2 + I_2 \longrightarrow 2HI$

15. In an Irreversible Reaction, Dynamic Equilibrium:

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

- (A) Never Establishes  
(C) Establishes after the completion of Reaction  
(D) Establishes Readily

- (B) Establishes before the completion

16. The reversible reaction is represented by:

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

- (A)  $\longrightarrow$  (B)  $\longrightarrow$  (C)  $\longleftarrow$  (D)  $\rightleftharpoons$

17. In the beginning the rate of reverse reaction is:

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

- (A) negligible (B) moderate (C) very fast (D) slow

18. \_\_\_\_\_ Possibilities are there at equilibrium state:

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

- (A) 4 (B) 2 (C) 3 (D) 1

19.  $2H_{2(g)} + O_{2(g)} \xrightarrow[\Delta]{Pt} 2H_2O_{(g)}$  this reaction is an example of:

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

- (A) Reversible (B) Forward (C) Reverse (D) Irreversible

## 9.2

## Law of Mass Action

20. For the reaction  $2A_{(g)} + B_{(g)} \rightleftharpoons 3C_{(g)}$  the expression for the equilibrium constant is:

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

- (A)  $\frac{[C]^3}{[A]^2[B]}$  (B)  $\frac{[3C]}{[2A][B]}$  (C)  $\frac{[A]^2[B]}{[C]^3}$  (D)  $\frac{[2A][B]}{[3C]}$

21. The rate constant for forward reaction is:

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

- (A)  $K_f$  (B)  $K_c$  (C)  $K_r$  (D)  $K_b$

22. For the reaction equilibrium constant expression  $H_2 + I_2 \rightleftharpoons 2HI$ :

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

- (A)  $K_c = \frac{[HI]^2}{[H_2][I_2]}$  (B)  $K_c = \frac{[H_2][I_2]}{[HI]^2}$  (C)  $K_c = \frac{[2HI]}{[H_2][I_2]}$  (D)  $K_c = \frac{[H_2][I_2]}{[2HI]}$

23. **Guldberg and Waage put forward Law of Mass Action in:**  
 (A) 1859 (B) 1869 (C) 1879 (D) 1889  
 ((LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II))
24. **Unit of active mass is:**  
 (A) mole dm (B) mole dm<sup>-1</sup> (C) mole dm<sup>-3</sup> (D) mole dm<sup>-2</sup>  
 (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)
25. **Equilibrium constant expression for given reaction is:**  $2NO_2 \rightleftharpoons N_2O_4$   
 (SGD-I/II, DGK-II, SWL-II)  
 (A)  $\frac{[NO_2]^2}{[N_2O_4]}$  (B)  $\frac{[N_2O_4]}{[NO_2]^2}$  (C)  $\frac{[N_2O_4]}{[2NO_2]}$  (D)  $\frac{[N_2O_4]}{[NO_2]}$
26. **Usually meant by active mass is:**  
 (A) Molar concentration (B) Reaction Quotient  
 (C) Reaction rate (D)  $K_c$  Expression  
 (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II)

## 9.3

## Equilibrium Constant and its Units

27. **When the numbers of moles of both sides are equal in a reaction, then the unit of  $K_c$  will be:**  
 (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) mol<sup>-2</sup> dm (B) mol dm<sup>3</sup> (C) mol<sup>-2</sup> dm<sup>6</sup> (D) No unit
28. **The units of equilibrium constant  $K_c$  for reaction in the balance chemical equation  $N_2 + 3H_2 \rightleftharpoons 2NH_3$  are:**  
 (SGD-I/II, DGK-II, SWL-II)  
 (A) mol dm<sup>-3</sup> (B) mol<sup>-1</sup> dm<sup>-3</sup> (C) mol<sup>-2</sup> dm<sup>6</sup> (D) No units
29. **The substance present on products sides are called:**  
 (A) Numerator (B) Denominator (C) Reactants (D) Products

## 9.4

## Importance of Equilibrium Constant

30. **The moderate value of  $K_c$  shows:** [LHR-II, MTN-II, DGK-I/II, FSD-II]  
 (A) Equilibrium will never establish  
 (B) Sufficient amount of reactant and product  
 (C) Reaction will go to completion (D) Amounts of products will be negligible

## Answers

|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | C | 2  | A | 3  | C | 4  | B | 5  | A | 6  | A | 7  | B | 8  | C | 9  | C | 10 | B |
| 11 | A | 12 | D | 13 | A | 14 | C | 15 | A | 16 | D | 17 | D | 18 | B | 19 | D | 20 | A |
| 21 | A | 22 | A | 23 | B | 24 | C | 25 | B | 26 | A | 27 | D | 28 | C | 29 | A | 30 | D |

## ALP Annual Paper 2021

## Short Questions

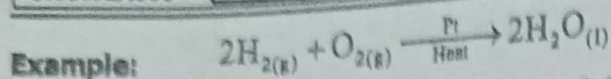
1. **What are irreversible reactions? Give a few characteristics of them.**

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans: Irreversible Reaction:** Reactions in which the products do not recombine to form reactants, are called irreversible reactions.

- (i) They are supposed to complete.  
 (ii) They are represented by putting a single arrow ( $\longrightarrow$ ) between the reactants and products.





2. What is meant by static equilibrium? Give one example.

(SGD-I/II, DGK-II, SWL-II)

Ans: **Static Equilibrium:** When reaction ceases to proceed, it is called static equilibrium. This happens mostly in physical phenomenon.

Example: A building remains standing rather than falling down because all the forces acting on it are balanced. This is an example of static equilibrium.

3. How is dynamic equilibrium established?

(SGD-GII, MTN-GII, FSD-GI, DGK-GI)

Ans: In a reversible reaction, dynamic equilibrium is established before the completion of reaction. At initial stage the rate of forward reaction is very fast and reverse reaction is taking place at a negligible rate. But gradually forward reaction slows down and reverse reaction speeds up. Eventually both reactions attain the same rate, it is called a dynamic equilibrium state.

4. Write any two characteristics of forward reaction.

(MTN-GI, SGD-GI, DGK-GI, GII, RSDGI, II)

Ans: **Characteristics of forward reaction:**

- (a) It is a reaction in which reactants react to form products.
- (b) It takes place from left to right.

5. Why do reversible reactions never complete?

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

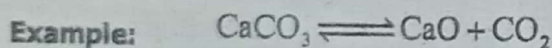
Ans: Reversible reactions never go to completion because products recombine to form reactants due to the fact that these reactions proceed in both ways and never go to completion.

6. What are reversible reactions? Give example.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans. **Reversible reactions:**

Reactions in which the products can recombine to form reactants are called reversible reactions.



7. Define the law of Mass Action.

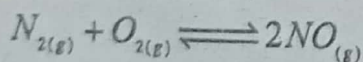
(MTN-GII, SGD-GI, II, RWL-GII, LHR-GI, II)

Ans: **Law of mass action:** Guldberg and Waage put forward this law in 1869.

According to this law: "The rate at which a substance reacts is directly proportional to its active mass and rate of reaction is directly proportional to the product of active masses of reacting substances."

Generally, an active mass is considered as the molar concentration having units of  $\text{mol dm}^{-3}$ , expressed as square brackets [ ].

8. Write the equilibrium Constant expression for the following reaction



(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

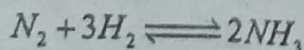
Ans: Equilibrium constant expression of:  $\text{N}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{NO}_{(g)}$

Rate of forward reaction:  $R_f = K_f [\text{N}_2][\text{O}_2]$

Rate of reverse reaction:  $R_r = K_r [\text{NO}]^2$

Equilibrium constant expression:  $K_c = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]}$

9. Write the Equilibrium Constant Expression for the given reaction.



Ans: **Rate of forward reaction:**

(GUJ-1, SGD-I/II, DGK-II, SWL-I/II)

$$R_f = K_f [\text{N}_2][\text{H}_2]^3$$



Rate of reverse reaction :

$$R_r = K_r [NH_3]^2$$

equilibrium constant expression:

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

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10. Define Chemical Equilibrium State.

(FSD-I, DGK-GII, MTN-GI, BWP-GI, II, RWP-GI, II,)

Ans: Chemical Equilibrium State:

When the rate of forward reaction takes place at the rate of reverse reaction, the composition of reaction mixture remains constants, It is called chemical equilibrium state.

11. What is equilibrium constant? Write down its unit as well.

(FSD-I, MLT-I, RWP-GI, II, UJ-GI, SGD-GII, BWP-GII, SWL-GII)

Ans: **Equilibrium Constant:** Equilibrium constant is a ratio of the product of concentration of products raised to the power of coefficient to the product of concentration of reactants raised to the power of coefficient as expressed in the balanced chemical equation.

$$K_c = \frac{\text{product of concentration of products raised to the power of coefficients}}{\text{product of concentration of reactants raised to the power of coefficients.}}$$

Units:

- (I)  $K_c$  has no units in reactions with equal number of moles on both sides of the equation. This is because concentration units cancel out in the expression for  $K_c$ .
- (II) For reactions in which the number of moles of reactants and product are not equal in the balanced chemical equation,  $K_c$  of course, have units.

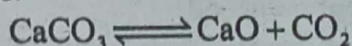
2014 - 2020

## 9.1

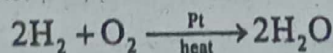
### Reversible Reaction and Dynamic Equilibrium

12. Define reversible and irreversible reactions. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: **Reversible reactions:** Reactions in which the products can recombine to form reactants are called reversible reactions.



**Irreversible reactions:** Reactions in which products do not recombine to form reactants are called irreversible reactions.

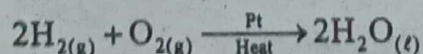


13. What is meant by reactants and products? Give an example.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: In a chemical reaction, the substances that combine are called reactants and the new substances formed are called products.

**Example:**  $H_2$  and  $O_2$  are reactants they combine to form  $H_2O$  (product).



14. Write two possibilities of chemical equilibrium state.

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: At equilibrium state, there are two possibilities.

- (I) When reaction ceases to proceed, It is called static equilibrium. This happens mostly in physical phenomenon. For example, a building remains standing rather than falling down because all the forces acting on it are balanced. This is an example of static equilibrium.



- (ii) When reaction does not stop, only the rates of forward and reverse reactions become equal to each other but take place in opposite directions. This is called dynamic equilibrium state. Dynamic means reaction is still continue at dynamic equilibrium state.  
Rate of forward reaction = Rate of reverse reaction

15. Differentiate between Reversible and Irreversible Reaction. Explain with example. (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans:

| Reversible Reaction   | Irreversible Reaction  |
|---|--|
| (i) Reactions in which the products can recombine to form reactants are called reversible reactions.  | (i) Reactions in which the products do not recombine to form reactants, are called irreversible reactions.     |
| (ii) These reactions never go to completion.  | (ii) They are supposed to complete.  |
| (iii) They are represented by a double arrow ( $\rightleftharpoons$ ) between reactants and products. | (iii) They are represented by putting a single arrow ( $\longrightarrow$ ) between the reactants and products. |
| Example: $H_2 + I_2 \rightleftharpoons 2HI$   | Example: $2H_{2(g)} + O_{2(g)} \xrightarrow[\text{Heat}]{Pt} 2H_2O_{(l)}$                                      |

16. Why the amounts of reactants and products do not change at equilibrium in a reversible reaction? (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans. In a reversible reaction, dynamic equilibrium is established before the completion of reaction. Rate of forward and reverse reactions become equal in dynamic equilibrium.

17. Complete the following equations: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)



Ans: a)  $CaCO_3 \rightleftharpoons CaO + CO_2$       b)  $H_2 + I_2 \rightleftharpoons 2HI$

18. Give two macroscopic characteristics of dynamic equilibrium. [GUJ-II, MTN-I, SGD-II]

Ans: (i) An equilibrium is achievable only in a closed system.  
(ii) An equilibrium state is attainable from either way.

19. What is active mass also write its units. [LHR-II, FSD-I, GUJ-I/II, DGK-II, MTN-I/II, SWL-II]

Ans: Active mass is considered as molar concentration having units of  $\text{mol dm}^{-3}$ .

20. How is the active mass represented?

Ans: Active mass is expressed as square bracket [ ]. [MTN-II, FSD-I, GUJ-II]

## 9.2

## Law of Mass Action

21. Write equilibrium constant expression for the reaction.  $PCl_3 + Cl_2 \rightleftharpoons PCl_5$

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans:  $PCl_3 + Cl_2 \rightleftharpoons PCl_5$

$$R_f = K_f [PCl_3] + [Cl_2]$$

$$R_r = K_r [PCl_5]$$

$$K_c = \frac{[PCl_5]}{[PCl_3][Cl_2]}$$

22. What is active mass? Also write its unit.

(DGK-GI, LHR--GII, BWP-GII)

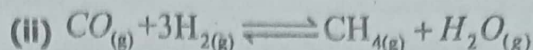
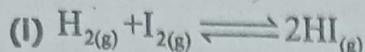
Ans: Active Mass: Active mass is considered molar concentration. It has a unit of  $\text{mol dm}^{-3}$  and expressed as square brackets as [ ].

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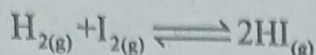


23. Write down the equilibrium constant expression for the following reaction:

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)



Ans.



Rate of forward Reaction

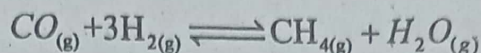
$R_f = K_f [\text{H}_2][\text{I}_2]$

Rate of reverse reaction

$R_r = K_r [\text{HI}]^2$

Equilibrium constant reaction

$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$



Rate of forward reaction

$R_f = K_f [\text{CO}][\text{H}_2]^3$

Rate of reverse reaction

$R_r = K_r [\text{CH}_4][\text{H}_2\text{O}]$

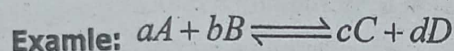
Equilibrium constant expression

$K_c = \frac{[\text{CH}_4][\text{H}_2\text{O}]}{[\text{CO}][\text{H}_2]^3}$

24. Write down the expression of  $K_c$  for a General Reversible Reaction.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans. The expression of  $K_c$  for a General Reversible Reaction is following.



The  $K_c$  value of this reaction is:

$K_c = \frac{[\text{C}]^c [\text{D}]^d}{[\text{A}]^a [\text{B}]^b}$

### 9.3

### Equilibrium Constant and its Units

25. What are numerator and denominator?

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans. In writing the equation of equilibrium constant, the substance present on products are written in "Numerator" and the substance present on reactants side are written "Denominator".

26. For which reactions Equilibrium constant has no units?

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: When  $K_c$  has no Units:

$K_c$  has no units in reactions with equal number of moles on both sides of the equation. This is because concentration units cancel out in the expression for  $K_c$ , e.g, for the reaction.

$\text{H}_{2(g)} + \text{I}_{2(g)} \rightleftharpoons 2\text{HI}_{(g)}$

$K_c = \frac{[\text{HI}_{(g)}]^2}{[\text{H}_{2(g)}][\text{I}_{2(g)}]} \text{ Units} = \frac{(\text{mol dm}^{-3})^2}{(\text{mol dm}^{-3})(\text{mol dm}^{-3})} = \text{no units}$



## 9.4

## Importance of Equilibrium Constant

27. Give importance of equilibrium constant.

[RWP-II, MTN-II, RWP-I]

Ans. If we know the numerical value of equilibrium constant of a chemical reaction, direction as well as extent of the reaction can be measured by us.

28. If reaction quotient of a reaction is more than  $K_c$ . What will be the direction of the reaction.

[RWP-II, MTN-II, RWP-I]

Ans. If  $Q_c > K_c$ ; the reaction goes from right to left, i.e. in reverse direction to attain equilibrium.

29. What is meant by  $Q_c = K_c$ ?

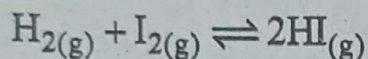
(swl-II)

Ans. If  $Q_c = K_c$  it means forward and reverse reactions are moving on at equal rate. i.e. reaction has attained equilibrium.

## 9.5

## Problems

**Problem 9.1:** When hydrogen reacts with iodine at  $25^\circ\text{C}$  to form hydrogen iodide by a reversible reaction as follow:



The equilibrium concentrations are:

$$[\text{H}_2] = 0.05 \text{ mol dm}^{-3}, [\text{I}_2] = 0.06 \text{ mol dm}^{-3}, [\text{HI}] = 0.49 \text{ mol dm}^{-3}$$

**Solution:** Given equilibrium concentrations are:

$$[\text{H}_2] = 0.05 \text{ mol dm}^{-3}, [\text{I}_2] = 0.06 \text{ mol dm}^{-3}, [\text{HI}] = 0.49 \text{ mol dm}^{-3}$$

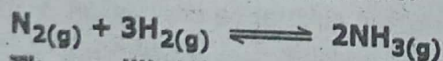
Equilibrium constant expression is

$$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$$

Put the values in equilibrium expression

$$K_c = \frac{[0.49]^2}{[0.05][0.06]} = \frac{0.2401}{0.0030} = 80 \text{ Ans.}$$

**Problem 9.2:** For the formation of ammonia by Haber's process hydrogen and nitrogen react reversibly at  $500^\circ\text{C}$  as follows.



The equilibrium concentrations of these gases are nitrogen  $0.602 \text{ mol dm}^{-3}$ ; hydrogen  $0.420 \text{ mol dm}^{-3}$  and ammonia  $0.113 \text{ mol dm}^{-3}$ . What is value of  $K_c$  solution.

The equilibrium concentrations are

$$[\text{N}_2] = 0.602 \text{ mol dm}^{-3}, [\text{H}_2] = 0.420 \text{ mol dm}^{-3}$$

$$[\text{NH}_3] = 0.113 \text{ mol dm}^{-3}$$

The equilibrium constant expression for this reaction i.e.:

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$

Now put the equilibrium concentration values into the equilibrium expression:

$$K_c = \frac{[0.113]^2}{[0.602][0.420]^3} = 0.286 \text{ mol}^{-2} \text{ dm}^6$$



**Problem 9.3:** For a reaction between  $\text{PCl}_3$  and  $\text{Cl}_2$  to form  $\text{PCl}_5$  the equilibrium constant is  $0.13 \text{ mol}^{-1} \text{ dm}^3$  at a particular temperature. When the equilibrium concentrations of  $\text{PCl}_3$  and  $\text{Cl}_2$  are  $10$  and  $9 \text{ mol dm}^{-3}$  respectively. What is equilibrium concentration of  $\text{PCl}_5$ .

**Solution:**

$$[\text{PCl}_3] = 10 \text{ mol dm}^{-3}, [\text{Cl}_2] = 9.0 \text{ mol dm}^{-3}$$

$$K_c = 0.13 \text{ mol}^{-1} \text{ dm}^3 [\text{PCl}_5] = ?$$

Now put the balanced chemical equation and equilibrium constant expression

$$K_c = \frac{[\text{PCl}_5]}{[\text{PCl}_3][\text{Cl}_2]}$$

Now put the known values in above equation and rearrange.

$$0.13 = \frac{[\text{PCl}_5]}{[10.0][9.0]}$$

$$[\text{PCl}_5] = 0.13 \times 10 \times 9 = 11.7 \text{ mol}^{-1} \text{ dm}^3$$

## Solved Exercise

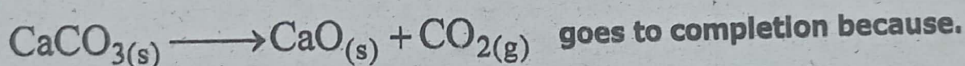
### Multiple Choice Questions

1. The characteristics of reversible reactions are the following except:

(DGK-GII,SGD-GII)(ALP)

- (a) Products never recombine to form reactants.
- (b) they never complete
- (c) they proceed in one way.
- (d) they have a double arrow between reactants and products

2. In the lime kiln, the reaction:



- (a) of high temperature
- (b)  $\text{CaO}$  is more stable than  $\text{CaCO}_3$
- (c)  $\text{CO}_2$  escapes continuously
- (d)  $\text{CaO}$  is not dissociated.

3. For the reaction,  $2\text{A}_{(g)} + \text{B}_{(g)} \rightleftharpoons 3\text{C}_{(g)}$  the expression for the equilibrium constant is:

(GUJ-GI,SGD-GII)(ALP)

- (a)  $\frac{[2\text{A}][\text{B}]}{[3\text{C}]}$
- (b)  $\frac{[\text{A}]^2[\text{B}]}{[\text{C}]^3}$
- (c)  $\frac{[3\text{C}]}{[2\text{A}][\text{B}]}$
- (d)  $\frac{[\text{C}]^3}{[\text{A}]^2[\text{B}]}$

4. When a system is at equilibrium state:

(RWP-GII)(ALP)

- (A) the concentration of reactants and products becomes equal
- (b) the opposing reactions (forward and reverse) stop
- (c) The rate of the reverse reaction becomes very low
- (d) the rates of the forward and reverse reactions become equal

5. Which one of the following statement is not correct about active mass?

(SWL-GI)(ALP)

- (a) rate of reaction is directly proportional to active mass
- (b) active mass is taken in molar concentration
- (c) Active mass is represented by square brackets
- (d) active mass means total mass of substance



6. When the magnitude of  $K_c$  is very large it indicates:

- (a) reaction mixture consists of almost all products
- (b) reaction mixture has almost all reactants.
- (c) Reaction has not gone to completion
- (d) Reaction mixture has negligible products.

7. When the magnitude of  $K_c$  is very small it indicates:

- (a) Equilibrium will never establish
- (b) All reactants will be converted to products
- (c) Reaction will go to completion
- (d) The amount of products is negligible

8. Reactions which have comparable amount of reactant and products at equilibrium state have:

- (a) Very small  $K_c$  value
- (b) Very large  $K_c$  value
- (c) Moderate  $K_c$  value
- (d) None of these

9. At dynamic equilibrium:

(GUJ-GI, FSD-I)(ALP)

- (a) The reaction stops to proceed
- (b) The amounts of reactants and products are equal
- (c) The speeds of the forward and reverse reactions are equal
- (d) The reaction can no longer be reversed

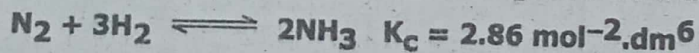
10. In an irreversible reaction dynamic equilibrium:

- (a) Never establishes
- (b) Establishes before the completion of reaction
- (c) Establishes after the completion of reaction
- (d) Establishes readily

11. A reverse reaction is one:

- (a) Which process from left to right
- (b) In which reactant react to form products
- (c) Which slows down gradually
- (d) Which speeds up gradually

12. Nitrogen and hydrogen were combined together to make ammonia:



What will be present in the equilibrium mixture?

(BWP-GI, DGK-GII, RWP-GI)(ALP)

- (a)  $NH_3$  only
- (b)  $N_2, H_2$  and  $NH_3$
- (c)  $N_2$  and  $H_2$  only
- (d)  $H_2$  only

13. For a reaction between  $PCl_3$  and  $Cl_2$  to form  $PCl_5$ , the units of  $K_c$  are;

(MLT-GI, BWP-GII, RWP-GI, BWP-GI)(ALP)

- (a)  $\text{mol dm}^{-3}$
- (b)  $\text{mol}^{-1} \text{ dm}^{-3}$
- (c)  $\text{mol}^{-1} \text{ dm}^3$
- (d)  $\text{mol dm}^3$

### Answers

|    |   |    |   |    |   |   |   |    |   |
|----|---|----|---|----|---|---|---|----|---|
| 1  | a | 2  | c | 3  | d | 4 | d | 5  | d |
| 6  | a | 7  | d | 8  | c | 9 | c | 10 | a |
| 11 | d | 12 | b | 13 | c |   |   |    |   |



### Short Questions

1. **What are Irreversible reaction? Give a few characteristics of them?**

**Ans.** Reactions in which only the reactants combine to form products are called irreversible reactions.

**Characteristics of Irreversible reaction:**

- (i) They are supposed to be complete.
- (ii) They are represented by putting a single arrow ( $\rightarrow$ ) between the reactants and products.
- (iii) They proceed in one direction only.

2. **Define chemical equilibrium state.**

(BWP-GI,SWL-GI,BWP-GII)(ALP)

**Ans.** When the rate of the forward reaction takes place at the rate of reverse reactions, the composition of the reaction mixture remains constant it is called a chemical equilibrium state.

3. **Give the characteristics of reversible reaction.**

(BWP-GI,SWL-GI)(ALP)

**Ans.** i) These reactions never go to completion.

- ii) They are represented by a double arrow ( $\rightleftharpoons$ ) between reactants and products.
- iii) These reactions proceed in both ways, i.e. they consist of two reactions; forward and reverse.
- iv) It speed up gradually.

4. **How dynamic equilibrium is established?**

**Ans.** In a reversible reaction, dynamic equilibrium is established before the completion of reaction. At initial stage the rate of forward reaction is very fast and reverse reaction is taking place at a negligible rate. But gradually forward reaction slows down and reverse reaction speeds up. Eventually both reactions attain the same rate, it is called a dynamic equilibrium state.

5. **Why at equilibrium state reaction does not stop?**

(BWP-GII,DGK-GI)(ALP)

**Ans.** At the equilibrium state the rate of forward and reverse reaction becomes equal because they keep on taking place at same rate, but in opposite directions. Therefore reaction does not stop.

6. **Why is equilibrium state is attainable from either way?**

(GUJ-GI)(ALP)

**Ans.** Equilibrium can be attained from either way i.e. Starting from reactants or from products. An equilibrium state can be disturbed and again achieved under the given conditions of concentration, pressure and temperature.

7. **What is relationship between active mass and rate of reaction?**

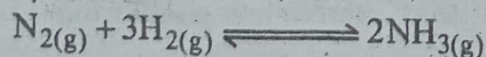
(BWP-GII)(ALP)

**Ans.** The rate at which a substance reacts is directly proportional to its active mass and the rate of a reaction is directly proportional to the products of the active masses of the reacting substances. It is represented by square bracket [ ].

8. **Derive equilibrium constant expression for the synthesis of ammonia from nitrogen and hydrogen.**

(LHR-I)(ALP)

**Ans.** For the reaction of nitrogen with hydrogen to form ammonia, the balanced chemical equation is:



For the reaction

$$\text{Rate of forward reaction } R_f = k_f [\text{N}_2] [\text{H}_2]^3$$

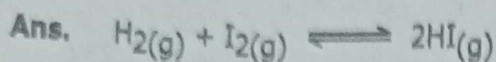
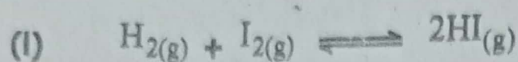
$$\text{Rate of reverse reaction } R_r = K_r [\text{NH}_3]^2$$

The expression for the equilibrium constant for this reaction is;

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$



9. Write the equilibrium constant expression of the following reactions.



Rate of forward reaction of this reaction.

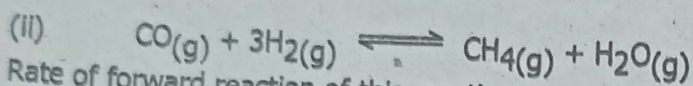
$$R_f = k_f [\text{H}_2][\text{I}_2]$$

Rate of reverse reaction of this reaction.

$$R_r = k_r [\text{HI}]^2$$

The equilibrium constant of this reaction is:

$$K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$$



Rate of forward reaction of this reaction.

$$R_f = k_f [\text{CO}][\text{H}_2]^3$$

Rate of reverse reaction of this reaction.

$$R_r = k_r [\text{CH}_4][\text{H}_2\text{O}]$$

The equilibrium constant of this reaction is:

$$K_c = \frac{[\text{CH}_4][\text{H}_2\text{O}]}{[\text{CO}][\text{H}_2]^3}$$

10. How direction of a reaction can be predicted?

Ans. Direction of reaction can be predicted by following ways.

If  $Q_c < K_c$ ; the reaction goes from left to right, i.e. in forward direction to attain equilibrium.

If  $Q_c > K_c$ ; the reaction goes from right to left, i.e. in reverse direction to attain equilibrium.

If  $Q_c = K_c$ ; Forward and reverse reaction take place at equal rate i.e. equilibrium has been attained.

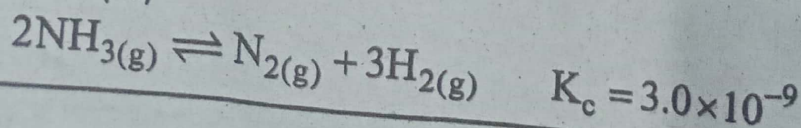
11. How can you know that a reaction has achieved an equilibrium state?

Ans. If  $Q_c = K_c$ ; forward and reverse reactions take place at equal rates. i.e. equilibrium has been attained. (SGD-GII)(ALP)

12. What are the characteristics of a reaction that establishes equilibrium state at once?

Ans. When the  $K_c$  value of reaction is small, it indicates the equilibrium has been established with a very small conversion of reactants to products. At equilibrium position, almost all reactants are present but amount of products is negligible. Such type of reaction never goes to completion.

For example;





13. If reaction quotient  $Q_c$  of a reaction is more than  $K_c$ . What will be the direction of the reaction?

Ans. If  $Q_c > K_c$ ; the reaction goes from right to left i.e., in reverse direction to attain equilibrium.

14. An industry was established based upon a reversible reaction. It failed to achieve products on commercial level. Can you point out the basic reasons of its failure being a chemist?

Ans. As reversible reactions are never completed they proceed on both directions. So an industry established on reversible bases failure to achieve products on commercial scale.

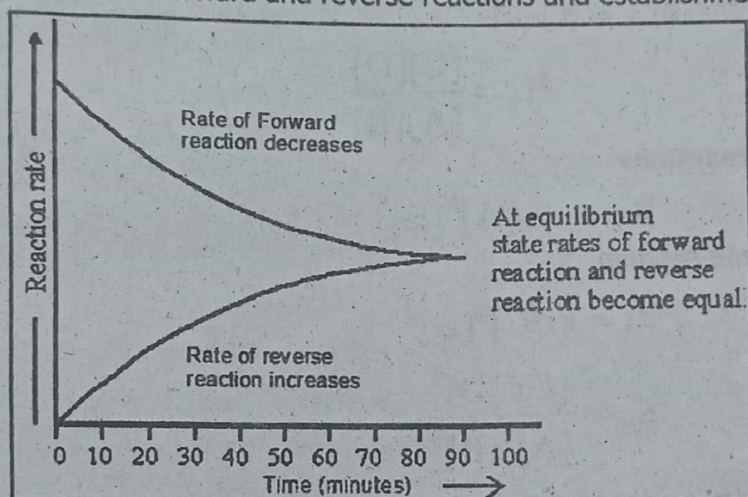
### Extensive Questions

1. Explain a reversible reaction with the help of graph.

[LHR-II, DGK-I, RWP-I/II]

Ans. The reactions in which products can recombine to form reactants are called reversible reactions. At initial stage the rate of forward reaction is very fast and reverse reaction is taking place at a negligible rate. But gradually forward reaction slows down and reverse reaction speeds up. Eventually both reactions attain the same rate, it is called a dynamic equilibrium state.

Graph shows the rate of forward and reverse reactions and establishment of equilibrium.



2. Write down the macroscopic characteristics of dynamic equilibrium.

[RWP-I, FSD-I, SGD-I, MTN-II]

Ans. Macroscopic Characteristics of dynamic equilibrium:

- An equilibrium is achievable only in a closed system (in which substances can neither leave nor enter).
- At equilibrium state a reaction does not stop. Forward and reverse reactions keep on taking place at same rate but in opposite direction.
- At equilibrium state, the amount (concentration) of reactants and products do not change. Even physical properties like color, density etc, remain the same.
- An equilibrium state is attainable from either way, i.e. starting from reactants or from products.
- Equilibrium state can be disturbed and again achieved under the given conditions of concentration, pressure and temperature.

3. State the law of mass action and derive the expression for equilibrium constant for a general reaction.

[BWP-II, RWP-I, DGK-II]

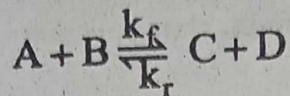
Ans. Guldberg and Waage in 1869 put forward this law. According to this law "The rate at which a substance reacts is directly proportional to its active mass and the rate of a reaction is directly proportional to the product of the active masses of the reacting substances."



**Units and representation:**

An active mass is considered as molar concentration in units of  $\text{mol dm}^{-3}$  expressed as square brackets [ ].

Consider for example, a reversible reaction of the types.



Suppose [A], [B], [C] and [D] are the molar concentrations ( $\text{mol dm}^{-3}$ ) of A, B, C and D respectively.

**Rate of forward reaction:**

$$\begin{aligned} \text{Rate of the forward reaction} &\propto [A][B] \\ &= k_f [A][B] \end{aligned}$$

**Rate of reverse reaction:**

$$\begin{aligned} \text{Rate of the reverse reaction} &\propto [C][D] \\ &= k_r [C][D] \end{aligned}$$

**At equilibrium:**

Rate of forward reaction = Rate of reverse reaction

$$k_f [A][B] = k_r [C][D]$$

$$K_c = \frac{[C][D]}{[A][B]}$$

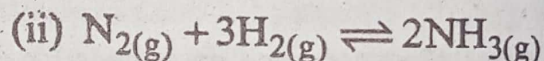
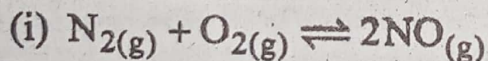
**Rate of forward reaction:**

$$R_f = K_f [A]^a [B]^b$$

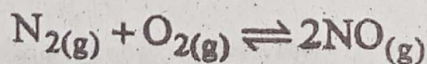
Rate of reverse reaction

$$R_r = k_r [C]^c [D]^d$$

$$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

**4. How we can express following reversible reactions in terms of chemical equilibrium constant?**

**Ans.** (i) When nitrogen reacts with oxygen to form nitrogen monoxide, the reversible reaction is as follows



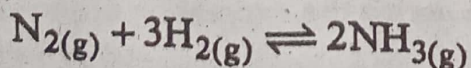
Rate of forward reaction  $R_f = k_f [\text{N}_2][\text{O}_2]$

Rate of reverse reaction  $R_r = k_r [\text{NO}]^2$

The equilibrium constant expression for this reaction is;

$$K_c = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]}$$

(ii) For the reaction of nitrogen with hydrogen to form ammonia, the balanced chemical equation is;



For the reaction

Rate of forward reaction  $R_f = k_f [\text{N}_2][\text{H}_2]^3$

Rate of reverse reaction  $R_r = k_r [\text{NH}_3]^2$

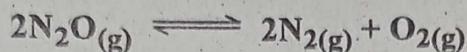


The expression for the equilibrium constant for this reaction is;

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$

### Numericals

1: For the decomposition of dinitrogen oxide ( $\text{N}_2\text{O}$ ) into nitrogen and oxygen reversible reaction takes place as follows.



The concentration of  $\text{N}_2\text{O}$ ,  $\text{N}_2$  and  $\text{O}_2$  are  $1.1 \text{ mol dm}^{-3}$ ,  $3.90 \text{ mol dm}^{-3}$  and  $1.95 \text{ mol dm}^{-3}$ , respectively, at equilibrium. Find out  $K_c$  for this reaction.

Data:

$$[\text{N}_2\text{O}] = 1.1 \text{ mol dm}^{-3} \quad [\text{N}_2] = 3.90 \text{ mol dm}^{-3}$$

$$[\text{O}_2] = 1.95 \text{ mol dm}^{-3}$$

Solution:

$$K_c = ?$$

$$K_c = \frac{[\text{N}_2]^2[\text{O}_2]}{[\text{N}_2\text{O}]^2} = \frac{(3.90)^2(1.95)}{(1.1)^2}$$

$$K_c = \frac{(15.21)(1.95)}{1.21}$$

$$K_c = \frac{2.96595}{1.21}$$

$$K_c = 24.51198 \text{ mol dm}^{-3}$$

StudyNotes.pk

2. Hydrogen iodide decomposes to form hydrogen and iodine. If the equilibrium concentration of HI is  $0.078 \text{ mol dm}^{-3}$ ,  $\text{H}_2$  and  $\text{I}_2$  is same  $0.011 \text{ mol dm}^{-3}$ , calculate the equilibrium constant value for this reversible reaction.

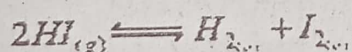
Data:

$$[\text{HI}] = 0.078 \text{ mol dm}^{-3},$$

$$[\text{H}_2] = 0.011 \text{ mol dm}^{-3}$$

$$[\text{I}_2] = 0.011 \text{ mol dm}^{-3}$$

Solution:

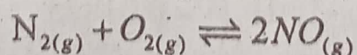


$$K_c = \frac{[\text{H}_2][\text{I}_2]}{[\text{HI}]^2}$$

$$K_c = \frac{(0.011)(0.011)}{(0.078)^2} = 0.0198$$

It has no unit.

3. For the fixation of nitrogen following reaction takes place:



When the reaction takes place at  $1500^\circ\text{C}$  the  $K_c$  for this is  $1.1 \times 10^{-5}$  If equilibrium concentration of nitrogen and oxygen are  $1.7 \times 10^{-5} \text{ mol dm}^{-3}$  and  $6.4 \times 10^{-5} \text{ mol dm}^{-3}$  respectively, how much NO is formed?

Data:

$$K_c = 1.1 \times 10^{-5}$$

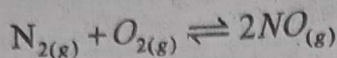


$$[N_2] = 1.7 \times 10^{-3} \text{ mol.dm}^{-3}$$

$$[O_2] = 6.4 \times 10^{-3} \text{ mol.dm}^{-3}$$

$$[NO] \text{ formation} = ?$$

**Solution:**



$$K_c = \frac{[NO]^2}{[N_2][O_2]}$$

Put the concentration values as:

$$1.1 \times 10^{-5} = \frac{[NO]^2}{[1.7 \times 10^{-3}][6.4 \times 10^{-3}]}$$

$$[1.1 \times 10^{-5}][1.7 \times 10^{-3}][6.4 \times 10^{-3}] = [NO]^2$$

$$1.1968 \times 10^{-10} = [NO]^2$$

Now, take square root on both sides.

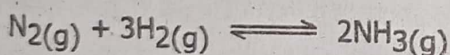
$$\sqrt{1.1968 \times 10^{-10}} = \sqrt{[NO]^2}$$

$$1.093 \times 10^{-5} = [NO]$$

$$[NO] = 1.093 \times 10^{-5} \text{ mol.dm}^{-3}$$

4. When nitrogen reacts with hydrogen to form ammonia, the equilibrium mixture contains  $0.31 \text{ mol.dm}^{-3}$  and  $0.50 \text{ mol.dm}^{-3}$  of nitrogen and hydrogen respectively. If the  $K_c$  is  $0.50 \text{ mol}^{-2}\text{dm}^6$ , what is the equilibrium concentration of ammonia?

**Data:**



$$[N_2] = 0.31 \text{ mol.dm}^{-3}, [H_2] = 0.50 \text{ mol.dm}^{-3}$$

$$K_c = 0.50 \text{ mol}^{-2}\text{dm}^6 [NH_3] = ?$$

**Solution:**

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$0.50 = \frac{[NH_3]^2}{(0.31)(0.50)^3}$$

$$[NH_3]^2 = 0.50 \times [0.31][0.50]^3$$

$$[NH_3]^2 = 0.01875$$

$$\sqrt{[NH_3]^2} = \sqrt{(0.050)(0.31)(0.50)^3}$$

$$NH_3 = \sqrt{0.01875}$$

$$NH_3 = 0.14 \text{ mol dm}^{-3}$$



## Chapter 10 Acid, Bases and Salts

All Punjab Past Board Papers  
2014 - 2021

## ALP Annual Paper 2021

## MCQ's

1. pH value of a Neutral solution is always: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) Less than 7 (B) Greater than 7 (C) Equal to 7 (D) Zero

2014 - 2020

## 10.1

## Concepts of Acids and Bases

2. Acids have taste: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A) bitter (B) sweetish (C) sour (D) salty
3. Bases have taste: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A) bitter (B) sweetish (C) sour (D) salty
4. The acid which is called king of chemical: (FSD G1)  
 (A) Sulphuric acid (B) Nitric acid (C) Hydrochloric acid (D) Acetic acid
5. Arrhenius Presented his concept of Acids and Bases in:  
 (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) 1787 (B) 1887 (C) 1987 (D) 1990
6. Bronsted-Lowry presented the concept of acids and bases in:  
 (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) 1787 A.D (B) 1823 A.D (C) 1923 A.D (D) 1943 A.D
7. Which is Lavoisier acid? (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A) HCl (B)  $H_2SO_4$  (C)  $CO_2$  (D)  $NH_3$
8. Which one is an amphoteric compound? (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A)  $H_2O$  (B)  $CO_2$  (C) HCl (D)  $CH_3COOH$
9. Among given compounds which is not Lewis acid?  
 (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A)  $H^+$  (B)  $BF_3$  (C)  $AlCl_3$  (D)  $NH_3$
10. The conjugate acid of  $CH_3 - NH_2$  is: (SGD-I/II, DGK-II, SWL-II)  
 (A)  $CH_3NH^+$  (B)  $CH_3NH^-$  (C)  $CH_3NH_3^+$  (D)  $CH_3NH_3^-$
11. Arrhenius concept is applicable only in:  
 (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A) Salty (B) Aqueous medium (C) Non-aqueous (D) Double salt
12. Which one is not an Arrhenius acid:  
 (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) HCl (B)  $H_2SO_4$  (C)  $CO_2$  (D)  $HNO_3$
13. Acid is a substance that gives Hydrogen ion in aqueous solution.  
 (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) Davy (B) Bronsted Lowery (C) Arrhenius (D) Lewis



2014 - 2020

## General Properties and uses of Acids and Bases

10.1.4 &amp; 5

- (RWP-GI, FSD-GI, II, BWP-GII)
14. Citric acid is found in: (C) milk (D) fats  
(A) lemon (B) apple (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)
15. Which base is more corrosive? (C)  $\text{Ca(OH)}_2$  (D)  $\text{Al(OH)}_3$   
(A)  $\text{NH}_4\text{OH}$  (B)  $\text{NaOH}$  (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)
16. Uric acid is found in: (C) Apple (D) Grapes  
(A) Urine (B) Fats
17. A base is a substance which neutralizes an acid. Among these \_\_\_\_\_ compound is not a base: (MTN-GI, RWP-GI)  
(A) Aqueous Ammonia (B) Calcium Oxide (C) Sodium Carbonate (D) Sodium Chloride
18. \_\_\_\_\_ is not an Acid: (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $\text{H}_2\text{SO}_4$  (B)  $\text{H}_2\text{CO}_3$  (C)  $\text{NH}_3$  (D)  $\text{HCl}$
19. Acid occurring in sour milk: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Citric Acid (B) Lactic Acid (C) Butyric Acid (D) Malic Acid
20. Which acid is used as an electrolyte in lead storage batteries: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Citric acid (B) Formic acid (C) Uric acid (D) Sulphuric acid
21. Malic acid is found in: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A) Lemon (B) sour milk (C) orange (D) apple
22. Which acid is used for food preservation? (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) Sulphuric acid (B) Nitric acid (C) Hydrochloric acid (D) Benzoic acid
23. The base which is used in alkaline batteries is: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
(A)  $\text{NaOH}$  (B)  $\text{Al(OH)}_3$  (C)  $\text{KOH}$  (D)  $\text{Mg(OH)}_2$
24. Which acid causes the acidity of stomach: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A) Sulphuric acid (B) Hydrochloric acid  
(C) Nitric acid (D) Oxalic acid
25. Which acid is found in orange? (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
(A) Uric acid (B) Formic acid (C) Malic acid (D) Citric acid
26. Which base is used to Neutralize Acidity in the Stomach: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
(A)  $\text{Ca(OH)}_2$  (B)  $\text{NaOH}$  (C)  $\text{Mg(OH)}_2$  (D)  $\text{KOH}$
27. Which one of the following compound is used to preserve meat and fish? (SGD-I/II, DGK-II, SWL-II)  
(A) Hydrochloric acid (B) Sodium hydroxide (C) Salt (D) benzene
28. The compound used for manufacturing of soap is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A)  $\text{NaOH}$  (B)  $\text{Ca(OH)}_2$  (C)  $\text{Al(OH)}_3$  (D)  $\text{NH}_4\text{OH}$
29. The natural source of formic acid is: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
(A) citrus fruits (B) sour milk (C) stings of bees (D) rancid butter
30. The colour of  $\text{Fe(OH)}_3$  is: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Brown (B) White (C) Blue (D) Dirty green



31. The base used for the treatment of bee's sting is:  
(GUJ-I/II,,MUL-I/II,SGD-I/II,DGK-II,SWL-II)
- (A)  $\text{NaOH}$  (B)  $\text{Mg}(\text{OH})_2$  (C)  $\text{KOH}$  (D)  $\text{NH}_4\text{OH}$

## 10.2

## pH Scale and Indicators

32. If a liquid has pH seven (7), then it must \_\_\_\_\_:  
(A) be colourless and odourless (B) freeze at  $0^{\circ}\text{C}$  and boil at  $100^{\circ}\text{C}$   
(C) be neutral (D) be a solution containing water  
(GUJ-GI, LHR-GI, RWP-GII, MTN-GII)
33. Sum of pOH and pH of a solution is:  
(A) 18 (B) 7 (C) 16 (D) 14  
(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)
34. Soda lime is a mixture of:  
(A)  $\text{CaCl}_2, \text{KOH}$  (B)  $\text{NaOH}, \text{CaO}$  (C)  $\text{NaOH}, \text{CaCl}_2$  (D)  $\text{Ca(OH)}_2, \text{CaO}$   
(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)
35. If the value of pH solution is less than seven it will be:  
(A) A base (B) An alkali (C) An acid (D) A neutral solution  
(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)
36. Sum of pH and pOH of solution at  $25^{\circ}\text{C}$  is always:  
(A) 14 (B) 12 (C) 10 (D) 8  
(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)
37. In strong alkaline solution the colour of Litmus becomes:  
(A) Pink (B) Yellow (C) Blue (D) Red  
(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)
38. In strong acidic solution the colour of Litmus becomes:  
(A) Red (B) Blue (C) Yellow (D) Colourless  
(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

## 10.3

## Salts

39. A natural salt is not composed of:  
(A) a metallic cation  
(C) an anion of a base  
(B) non-metallic anion  
(D) an anion of an acid  
(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)
40. A reaction between an acid and a base produces:  
(A) salt and water  
(B) salt and gas  
(C) salt and acid  
(D) salt and base  
(GUJ-GI, II, LHR-GI, FSD-GI, LHR-GII, DGK-GI)
41.  $\text{Ca}(\text{OCl})\text{Cl}$  is an example of:  
(A) normal salts  
(B) double salts  
(C) mixed salts  
(D) complex salts  
(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)
42. Bleaching Powder is the example of:  
(A) Acidic Salt  
(B) Double Salt  
(C) Mixed salt  
(D) None of these  
(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)
43. Molecular Formula of Mohr's Salt is:  
(A)  $\text{ZnSO}_4$   
(B)  $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$   
(C)  $\text{NaH}_2\text{PO}_4$   
(D)  $\text{K}_2\text{SO}_4 \cdot \text{Fe}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$   
(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

## Answers

|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | C | 2  | C | 3  | A | 4  | A | 5  | A | 6  | C | 7  | C | 8  | A | 9  | D | 10 | C |
| 11 | B | 12 | C | 13 | C | 14 | A | 15 | B | 16 | A | 17 | D | 18 | C | 19 | B | 20 | D |
| 21 | D | 22 | D | 23 | C | 24 | B | 25 | D | 26 | C | 27 | C | 28 | A | 29 | C | 30 | A |
| 31 | B | 32 | C | 33 | D | 34 | B | 35 | C | 36 | A | 37 | C | 38 | A | 39 | C | 40 | A |
| 41 | C | 42 | C | 43 | B |    |   |    |   |    |   |    |   |    |   |    |   |    |   |



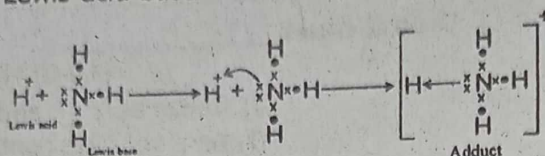
## ALP Annual Paper 2021

## Short Questions

(SWL-GI, GII, LHR-GI, DGK-GII)

## 1. Define adduct.

**Ans:** The products of any Lewis acid-base reaction is a single specie called an adduct.

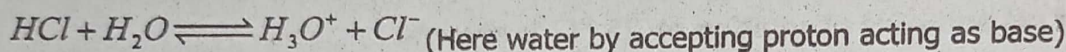
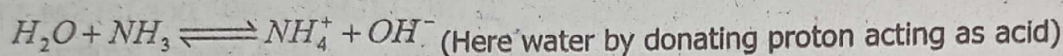


## 2. Prove that water is an amphoteric specie. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans: Water is amphoteric specie:**

A substance that can behave as an acid as well as a base is called amphoteric.

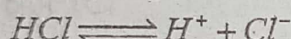
For example water is an amphoteric specie because it can behave as an acid as well as base.



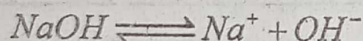
## 3. Define acid and base according to Arrhenius concept.

(RWP-GI, GUJ-GI, MTN-GI, LHR-GI, II, BWP-GII)

**Ans:** Arrhenius Concept of Acid and Base: Acid is a substance which dissociates in aqueous solution to give hydrogen ions. For example HCl.



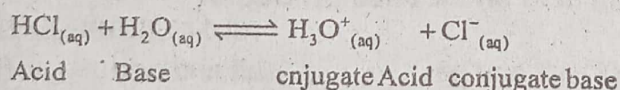
Base is substance which dissociates in aqueous solution to give hydroxide ions. For example NaOH.



## 4. What is conjugate acid? Define it.

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans:** A conjugate acid is a specie formed by accepting a proton by a base.



## 5. Write two physical properties of Acids.

(GUJ-GI, BWP-GI, RWP-GI, SGD-GII)

**Ans:** (i) Acids have sour taste. For example, unripe citrus fruits or lemon juice.

(ii) They turn blue litmus red.

## 6. Give four uses of Nitric acid.

(LHR-I/II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-I, SWL-II)

**Ans: Uses of Nitric acid:**

(i) It is used to manufacture fertilizer (ammonium nitrate).

(ii) It is used to make paints.

(iii) It is helpful in making drugs.

(iv) It is used to make etching designs on copper plates.

## 7. Write any four uses of bases.

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans: Uses of bases:** (i) Sodium hydroxide is used for manufacture of soap.

(ii) Calcium hydroxide is used for softening of hard water.

(iii) Potassium hydroxide is used in alkaline batteries.

(iv) Magnesium hydroxide is used to neutralize acidity in the stomach.



8. Write the names and formula of any two mineral acids.

(RWP-GII, MTN-GII, BWP-GII)

Ans: Names of mineral acids along with their formula are as follows:

- i) Hydrochloric acid ( $\text{HCl}$ )
- ii) Sulphuric acid ( $\text{H}_2\text{SO}_4$ )

9. Define hyper acidity.

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: Sometimes stomach produces too much acid. It causes stomach acidity also called hyperacidity. Symptoms of this disease are feeling burning sensation throughout the gastro intestinal track. These feelings sometimes extend towards the chest, that is called heart burning.

10. Write two uses of pH.

(SGD-GI, II, DGK-GI, II, SP-GII, FSD-GI)

Ans: Two Uses of pH:

- (i) It is used to determine acidic or basic nature of a solution.
- (ii) It is used to prepare medicine, culture at microbiological particular concentration of  $\text{H}^+$  ion.

11. What are indicators? Name any two indicators.

(GUJ-GII, BWP-GI, DGK-GI)

Ans: Indicator: Indicators are the organic compounds. They have different colours in acidic and alkaline solutions. For example phenolphthalein and methyl orange.

12. Define salts.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II, FSD-I)

Ans: Salts are ionic compounds generally formed by the neutralization of an acid and base. These are made up of positive ions (cations) and negative ions (anions). Cation is called basic radical while anion is called acidic radical.

13. How soluble salt recovered from water?

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Soluble salts are often prepared in water. And they are recovered by evaporation or crystallization process.

14. Write down two uses of sulphuric acid.

(LHR-GI, II, GUJ-GI, MTN-GI, SWL-GI, II, FSD-I)

Ans: Uses of sulphuric acid:

- (i) It is used for manufacturing fertilizers, ammonium sulphate, calcium super phosphate.
- (ii) It has also application in lead storage batteries as electrolyte.

15. Write formula of calcium phosphate and silver acetate.

[LHR-II, MTN-I, DGK-I, FSD-II]

Ans: Calcium Phosphate:  $\text{Ca}_3(\text{PO}_4)_2$

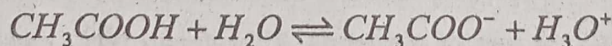
Silver Acetate:  $\text{CH}_3\text{COOAg}$

16. Define conjugate acid and conjugate base.

[MTN-I, SGD-I, SWL-II, BWP-I/II]

Ans: Conjugate Acid: A conjugate acid is a species formed by accepting a proton by base.

Conjugate Base: A conjugate base is a species formed by donating a proton by an acid.



Acid

Base

Conjugate base

Conjugate acid

17. Give two characteristics properties of salts.

[DGK-I/II, SGD-I, BWP-II, MTN-II, FSD-I]

Ans: (i) Salts are made up of ions.

(ii) They have high melting and boiling points.

18. Write two uses of Hydrochloric acid.

[GUJ-II, FSD-II, SWL-I]

Ans: (i) HCl is used in printing industries.

(ii) HCl is used for cleaning metals.

## 10.1

## Concepts of Acids and Bases

19. Write down any two limitations of Arrhenius concept.

(GUJ-GII, FSD-GWP-GI, SGD-GII, DGK-GII)

Ans: Limitations of Arrhenius concept:

- (i) This concept is applicable only in aqueous medium and does not explain nature of acids and bases in non-aqueous medium.



- (ii) According to this concept, acids and bases are only those compounds which contain hydrogen ( $H^+$ ) and hydroxyl ( $OH^-$ ) ions, respectively. It can not explain the nature of compounds like  $CO_2$ ,  $NH_3$  etc which are acid and base, respectively.

(RWP-GI,BWP-GI)

**20. Define base and give an example.**

**Ans:** Base is a substance which dissociates in aqueous solution to give hydroxide ions.

**Example:** NaOH and KOH are bases.

**21. Define Lewis base and give one example.**

(LHR-I/II,MUL-I,SGD-I,DGK-I/II,SWL-I/II)

**Ans:** According to Lewis concept, Base is a substance (molecule or ion) which can donate a pair of electrons.

**Example:**  $NH_3$ ,  $CN^-$

**22. What do you mean by Conjugate Bases? Give one example.**

(LHR-I/II,FSD-I,DGK-I,SWL-I,MUL-II)

**Ans:** A conjugate base is a species formed by donating a proton by an acid.

**Example:**  $Cl^-$  ion is called a conjugate base of acid HCl.

**23. What is the difference between Arrhenius Bases and Bronsted Bases?**

(GUJ-I,FSD-I,DGK-I,SWL-I,MUL-II)

**Ans:**

| Arrhenius Base  | Bronsted Base   |
|---|---|
| According to Arrhenius concept, Base is a substance which dissociates in aqueous solution to give hydroxide ions. | According to Bronsted concept, Base is a substance that can accept a proton ( $H^+$ ) from another substance. |
| <b>Example:</b> NaOH and KOH are Arrhenius bases.   | <b>Example:</b> $NH_3$  |

**24. What is difference between Lewis acid and base?**

(SWL-GII,DGK-GI,II,LHR-GII)

**Ans: Lewis Acid:** An acid is a substance which can accept a pair of electron e.g.  $H^+$ ,  $BF_3$  are acids.

**Lewis Base:** A base is a substance which can donate a pair of electrons e.g.  $OH^-$ ,  $NH_3$  are bases.

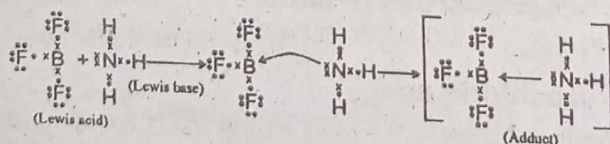
**25. Why  $BF_3$  acts as Lewis acid and  $NH_3$  as Lewis base.**

(FSD-I/II,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

**Ans:  $BF_3$  as Lewis acid:**

In  $BF_3$  the central atom boron has incomplete octet and has only six electrons around it, therefore  $BF_3$  can accept an electron pair to behave as a Lewis acid.

**$NH_3$  as Lewis base:** According to Lewis base, it must donate an electron pair. In  $NH_3$ , central atom has one lone pair of electrons. Therefore,  $NH_3$  can donate an electron pair to behave as a Lewis base.

**26. Why  $BF_3$  behaves as a Lewis Acid?**

(LHR-I/II,MUL-I,SGD-I,DGK-I/II,SWL-I/II)

**Ans:** According to Lewis acid it must accept an electron pair. In  $BF_3$  the central atom boron has incomplete octet and has only six electrons around it, therefore  $BF_3$  can accept an electron pair to behave as a Lewis acid.

**27. Write Conjugate acid of each of the following:-**i.  $NH_3$ ii.  $HCO_3^{-1}$ 

[DGK-II,MTN-I]

**Ans:** (i) Conjugate acid of  $NH_3$  is  $NH_4^+$  (ii) Conjugate acid of  $HCO_3^{-1}$  is  $H_2CO_3$ .



28.  $\ddot{\text{N}}\text{H}_3$  and  $\text{R}-\ddot{\text{N}}\text{H}_2$  acts as Lewis base. Explain. (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans:  $\text{NH}_3$  and  $\text{R}-\ddot{\text{N}}\text{H}_2$  acts as Lewis base because they contain a lone pair of electrons.

**10.1.4 & 5****General Properties and uses of Acids and Bases**

29. Name two acids used in the manufacture of fertilizers. MTN-GI, LHR-GI, FSD-GII, SGD-G

Ans: (i) Sulphuric acid is used to manufacture fertilizers, ammonium sulphate, calcium superphosphate.

(ii) Nitric acid is used in the manufacturing of ammonium nitrate fertilizers.

30. Name the alkali used in alkaline batteries. (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: Potassium Hydroxide (KOH) is used in alkaline batteries.

31. Write the name of acid present in. (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

(a) Vinegar (b) Ant sting

Ans: Acid present in vinegar is Acetic acid.

Acid present in Ant sting is Formic acid.

32. Give two uses of Acetic acid. (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Uses of Acetic Acid:

- 1) Acetic acid is used for flavoring food and food preservation.
- 2) It is also used to cure the sting of wasps.

33. Write sources of Citric acid and Lactic acid.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Citric acid and Lactic acid:

Source of Citric acid is : Citrus fruits i.e. lemon, oranges etc.

Source of Lactic acid is: Sour milk.

34. Write any two characteristics (properties) of bases.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Characteristics of bases: (i) Bases have bitter taste and feel slippery for example soap.  
(ii) They turn red litmus to blue.

35. Write down any two uses of magnesium hydroxide. (SGD-GI, RWP-GI, BWP-GI)

Ans: Uses of magnesium hydroxide:

- (i) It is used as a base to neutralize acidity in stomach
- (ii) It is used for the treatment of bee stings.

36. Which acids are found in urine and lemon? (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: Acids in Urine and Lemon:

|       |             |
|-------|-------------|
| Urine | Uric acid   |
| Lemon | Citric acid |

37. Write formula of an acid and base. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Acid: Sulphuric acid Formula:  $\text{H}_2\text{SO}_4$

Base: Sodium Hydroxide Formula:  $\text{NaOH}$

38. Write uses of Sodium Hydroxide and Potassium Hydroxide.

(SGD-I/II, DGK-II, SWL-II)

Ans: Uses of sodium hydroxide and potassium hydroxide:

- (a) Sodium hydroxide is used for manufacturing of soap.
- (b) Sodium hydroxide is used in textile industries in dyeing and printing.  
Potassium Hydroxide is used in alkaline batteries.



39. Which acid is present in apples?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Malic acid is present in apples.

40. Name the acids present in rancid butter and citrus fruits.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Butyric acid is present in rancid butter, While citric acid is present in citrus fruits.

41. Name the acids present in vinegar and citrus fruit.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Acetic acid is present in vinegar while citric acid is present in citrus fruit.

42. Write formula of Calcium Hydroxide. Also describe its one use.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Formula of Calcium hydroxide:  $\text{Ca(OH)}_2$

Use: Calcium hydroxide is used to make bleaching powder and to soften hard water.

43. Write chemical formula and use of Ammonium hydroxide.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Chemical Formula:  $\text{NH}_4\text{OH}$

Use of Ammonium hydroxide: It is used to remove grease stains from clothes.

44. Write two preventions from hyperacidity. (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: The best prevention from hyperacidity is:

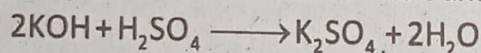
- Avoiding over-eating and staying away from fatty acids and spicy foods.
- Simple and regular eating, remaining in an upright position for about 45 minutes after taking a meal.

45. Write any two chemical properties of bases.

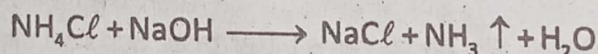
(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans: Chemical properties of Bases:

- Bases react with acids to form salt and water.



- Bases react with ammonium salt to liberate ammonia gas.



46. Write down formulas of the following.

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

(a) Nitric acid

(b) Phosphoric acid

(c) Calcium Hydroxide

(d) Aluminium Hydroxide

Ans:

| Compound                | Chemical Formula        |
|-------------------------|-------------------------|
| (a) Nitric Acid         | $\text{HNO}_3$          |
| (b) Phosphoric Acid     | $\text{H}_3\text{PO}_4$ |
| (c) Calcium Hydroxide   | $\text{Ca(OH)}_2$       |
| (d) Aluminium Hydroxide | $\text{Al(OH)}_3$       |

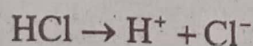
## 10.2

## pH Scale

47. A solution of HCl is 0.01M. What is its pH value?

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Solution: Hydrochloric acid is a strong acid so it ionizes completely i.e.



so, its solution contains 0.01 M  $\text{H}^+$  ions i.e.  $10^{-2}$  M



$$\text{pH} = -\log [\text{H}^+]$$

By putting values of  $\text{H}^+$  ions in above equation

$$\text{pH} = -\log 10^{-2}$$

$$\text{pH} = 2.$$

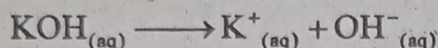
**48. Why pure water is not a strong electrolyte?** (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans:** Pure water is not a strong electrolyte because it ionizes very slightly into ions in the process called auto ionization or self ionization.

**49. Find out the pOH of 0.001M solution of KOH.**

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans:** pH of 0.001 M KOH solution



$$[\text{OH}^-] = 0.001\text{M}$$

$$\text{pOH} = -\log [\text{OH}^-]$$

$$= -\log (0.001) = -\log (10^{-3})$$

$$\text{pOH} = -(-3) \log 10$$

$$= +3 \log 10 \quad (\log 10=1)$$

$$\text{pOH} = 3 (1) = 3$$

**50. Define pH scale. Write its range.** (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** pH scale: A scale is developed with the reference of following equation according to the molar concentration of  $\text{H}^+$  ions that is called pH scale. It ranges for 0 to 14.

$$\text{pH} = -\log [\text{H}^+]$$

**51. What is the purpose of pH meter?** (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** The pH of a solution can be measured with a pH meter. Its electrode is dipped into the solution and the meter shows the pH either on scale or digitally. It is more reliable and accurate method of measuring pH than Universal indicator paper.

**52. Write the names of two indicators which are used in titration.**

(SGD-I/II, DGK-II, SWL-II)

**Ans:** Indicators used in titration are as follows:

- i) Methyl orange                      ii) Phenolphthalein

**53. How pH of a solution is measured by using universal indicator?**

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans:** Some indicators are used as mixtures. The mixture indicators give different colours at different pH values. Universal indicator paper is dipped in solution and its color is compared with standard chart to measure pH values. Such a mixed indicator is called universal indicator or simply pH indicator.

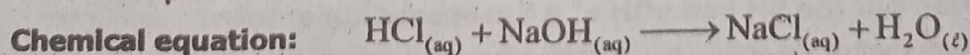
## 10.3

## Salts

**54. What is neutralization reaction? Write a chemical equation as well.**

(RWP-GI, DGK-GI, MTN-GI)

**Ans: Neutralization reaction:** A reaction between an acid and a base is called a neutralization reaction. It produces a salt and water.



**55. How are the salts named?**

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans:** The salt gets its name from the names of the metal and the acid.

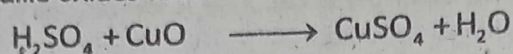


| Metal         | Acid                            | Salt name                             |
|---------------|---------------------------------|---------------------------------------|
| Sodium (Na)   | Hydrochloric acid (HCl)         | Sodium chloride (NaCl)                |
| Potassium (K) | Nitric acid (HNO <sub>3</sub> ) | Potassium nitrate (KNO <sub>3</sub> ) |

56. How salt is prepared by the reaction of an acid and metallic oxide.

(SGD-I/II, DGK-II, SWL-II)

Ans: Mostly the insoluble metallic oxides react with dilute acids to form salts and water.

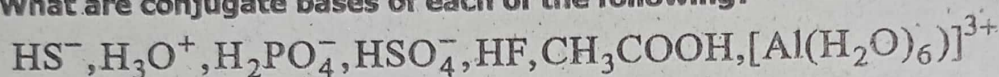


## 10.4

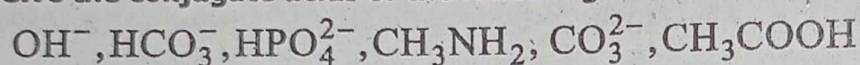
## Problems

Problem 10.1:

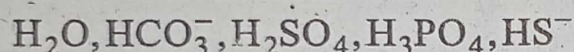
(a) What are conjugate bases of each of the following?



(b) Give the conjugate acids of the following:



(c) Which of the following behave both as Bronsted acids and Bronsted bases?



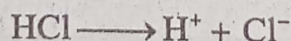
Solution:

| (a)                                      | Conjugate bases                                   | (b)                      | Conjugate acids              |
|--|---|--------------------------|------------------------------|
| $\text{HS}^-$                            | $\text{S}^{2-}$                                   | $\text{OH}^-$            | $\text{H}_2\text{O}$         |
| $\text{H}_3\text{O}^+$                   | $\text{H}_2\text{O}$                              | $\text{HCO}_3^-$         | $\text{H}_2\text{CO}_3$      |
| $\text{HF}$                              | $\text{F}^-$                                      | $\text{CH}_3\text{NH}_2$ | $\text{CH}_3\text{NH}_3^+$   |
| $\text{H}_2\text{PO}_4^-$                | $\text{HPO}_4^{2-}$                               | $\text{HPO}_4^{2-}$      | $\text{H}_2\text{PO}_4^-$    |
| $\text{HSO}_4^-$                         | $\text{SO}_4^{2-}$                                | $\text{CO}_3^{2-}$       | $\text{HCO}_3^-$             |
| $\text{CH}_3\text{COOH}$                 | $\text{CH}_3\text{COO}^-$                         | $\text{CH}_3\text{COOH}$ | $\text{CH}_3\text{COOH}_2^+$ |
| $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$ | $[\text{Al}(\text{H}_2\text{O})_5\text{OH}]^{2+}$ |                          |                              |

(c) Bronsted acids, as well as, bases are:  $\text{H}_2\text{O}, \text{HCO}_3^-, \text{HS}^-$

Problem 10.2: A solution of Hydrochloric acid is 0.01M. What is its pH value?

Solution: Hydrochloric acid is a strong acid so it ionizes completely. That is,



So, its solution also contains 0.01 M  $\text{H}^+$  ions in the equation i.e.,  $10^{-2}\text{M}$

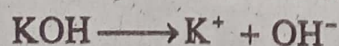
$$\text{pH} = -\log[\text{H}^+]$$

$$\text{pH} = -\log[10^{-2}]$$

$$\text{pH} = 2$$

Problem 10.3: Find out the pH and pOH of 0.001M solution of KOH?

Solution: Potassium hydroxide solution is a strong base. It ionizes completely such that one mole of KOH gives one mole of  $\text{OH}^-$  ions.





Therefore, 0.001M solution of KOH produced 0.001M OH<sup>-</sup> ions.

$$[\text{OH}^-] = 0.001\text{M} = 10^{-3}\text{M}$$

$$\text{pOH} = -\log[\text{OH}^-]$$

$$\text{pOH} = -\log 10^{-3} = 3$$

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} = 14 - \text{pOH} = 14 - 3$$

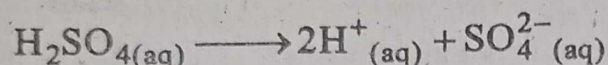
$$\text{pH} = 11$$

StudyNotes.pk

**Problem 10.4 Find the pH of 0.01M sulphuric acid?**

**Solution:**

Sulphuric acid is a strong dibasic acid. It ionizes completely and its one mole produces 2 moles of hydrogen ions as presented in equation.



Therefore, 0.01M sulphuric acid will produce  $2 \times 0.01\text{M}$  hydrogen ions.

Hence, hydrogen ions concentration is

$$[\text{H}^+] = 2 \times 10^{-2}\text{M}$$

$$\text{pH} = -\log [\text{H}^+]$$

$$\text{pH} = -\log(2 \times 10^{-2}) = -(\log 2 + \log 10^{-2})$$

$$\text{pH} = -\log 2 - \log 10^{-2} \quad \text{as } -\log 10^{-2} = 2$$

$$\text{pH} = 2 - \log 2 \quad \text{pH} = 2 - 0.3 = 1.7$$

### Solved Exercise

#### Multiple Choice Questions

- A base is a substance which neutralizes an acid. Which of these substances not a base?**
  - Aqueous ammonia
  - Sodium chloride
  - Sodium carbonate
  - Calcium oxide
- Lewis acid-base concept have the following characteristics except:** (RWP-II)(ALP)
  - Formation of an adduct
  - Formation of a co-ordinate covalent bond.
  - Donation and acceptance of an electron pair
  - Donation and acceptance of a proton.
- Acetic acid is used for:** (RWP-I, BWP-I)(ALP)
  - Flavouring food
  - Making explosives
  - Etching designs
  - Cleaning metals
- A salt is not composed of:**
  - A metallic cation
  - Non-metallic anion.
  - An anion of base
  - An anion of an acid
- If a liquid has a pH of 7 then it must:**
  - Be a colourless and odourless liquid
  - Freeze at 0°C and boils at 100°C
  - Be neutral
  - Be a solution containing water.
- A salt always:**
  - Contains ions
  - Contains water of crystallization
  - Dissolves in water
  - forms crystals which conduct electricity



7. Dilute acids react with carbonates to produce the given products except:  
 (a) Salt (b) Water (c) Carbon dioxide (d) Hydrogen
8. In the preparation of insoluble salts, which one of the facts is incorrect?  
 (a) Two soluble salts are mixed (b) Ions of both salts are exchanged  
 (c) One of the salts produced is insoluble (d) Both of the salts produced are insoluble
9. A reaction between an acid and a base produces: (SWL-I,DGK-I)(ALP)  
 (a) Salt and water (b) Salt and gas (c) Salt and an acid (d) Salt and a base
10. The conjugate acid of  $\text{HPO}_4^{2-}$  is: (MLT-I,SRG-II)(ALP)  
 (a)  $\text{PO}_4^{3-}$  (b)  $\text{H}_2\text{PO}_4^{2-}$  (c)  $\text{H}_2\text{PO}_4^-$  (d)  $\text{H}_2\text{PO}_4$
11. What is the pOH of a 0.02M  $\text{Ca}(\text{OH})_2$ ? (MLT-I,GUJ-I,DGK-II,FSD-I)(ALP)  
 (a) 1.698 (b) 1.397 (c) 12.31 (d) 12.61
12. Which one of the following species is not amphoteric?  
 (a)  $\text{H}_2\text{O}$  (b)  $\text{NH}_3$  (c)  $\text{HCO}_3^-$  (d)  $\text{SO}_4^{2-}$
13. The product of Lewis acid-base reaction is called adduct. The bond between the adduct specie is:  
 (a) ionic (b) covalent  
 (c) metallic (d) co-ordinat covalent
14. The water of crystallization is responsible for the:  
 (a) Melting points of crystals (b) Boilling points of crystals.  
 (c) Shapes of crystals (d) Transition points of crystals
15. You want to dry a gas which one of the following salts you will use:  
 (a)  $\text{CaCl}_2$  (b)  $\text{NaCl}$  (c)  $\text{CaO}$  (d)  $\text{Na}_2\text{SiO}_3$
16. Ferric hydroxide  $\text{Fe}(\text{OH})_3$  is precipitated out of solution when aqueous sodium hydroxide solution is added to ferric chloride ( $\text{FeCl}_3$ ).  

$$\text{FeCl}_{3(\text{aq})} + 3\text{NaOH}(\text{aq}) \longrightarrow \text{Fe}(\text{OH})_{3(\text{s})} + 3\text{NaCl}_{(\text{aq})}$$
 Colour of the precipitate is:  
 (a) white (b) blue (c) dirty green (d) brown
17. Which ion is the conjugate base of sulphuric acid?  
 (a)  $\text{SO}_4^{2-}$  (b)  $\text{S}^{2-}$  (c)  $\text{HSO}_3^-$  (d)  $\text{HSO}_4^-$
18. Which one of the following is a Lewis base?  
 (a)  $\text{NH}_3$  (b)  $\text{BF}_3$  (c)  $\text{H}^+$  (d)  $\text{AlCl}_3$
19. According to the Lewis concept, acid is a substance which can:  
 (a) Donate a proton (b) Donate a pair of electron  
 (c) Accept a proton (d) Accept a pair of electron
20. Given  $K_w = [\text{H}^+][\text{OH}^-] = 1 \times 10^{-14}$  at  $25^\circ\text{C}$ :  
 What is the concentration of  $\text{H}^+$  in pure water at  $25^\circ\text{C}$ ?  
 (a)  $1 \times 10^{-7} \text{ mol dm}^{-3}$  (b)  $1 \times 10^7 \text{ mol dm}^{-3}$   
 (c)  $1 \times 10^{-14} \text{ mol dm}^{-3}$  (d)  $1 \times 10^{14} \text{ mol dm}^{-3}$



## Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | B | 2  | D | 3  | A | 4  | C | 5  | C |
| 6  | A | 7  | D | 8  | D | 9  | A | 10 | C |
| 11 | B | 12 | B | 13 | D | 14 | C | 15 | C |
| 16 | D | 17 | D | 18 | A | 19 | D | 20 | A |

## Short Questions

1. Name the common house hold substances having.

(a) pH value greater than 7.

Ans. (i) Mint (ii) Milk of magnesia  $Mg(OH)_2$   
(iii) Caustic soda  $NaOH$

(b) pH value less than 7.

Ans. (i) Potatoes (ii) Sour Milk (Lactic acid)  
(iii) Apple (Malic acid)

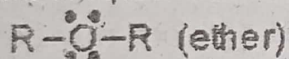
(c) pH value equal to 7.

Ans. (i) Water  $H_2O$  (ii) Table salt solution  $NaCl$   
(iii) Calcium chloride  $CaCl_2$

2. Define a base and explain all alkalis are bases, but all bases are not alkalis.

Ans. According to different acid-base theories, Base is a substance that has capacity to release  $OH^-$  ions in aqueous solution, accept a proton and donate electron pair. While the term alkali is specifically limited to its capacity of releasing  $OH^-$  ions in aqueous solution, acting as a soluble base. So on basis of above mentioned facts, it can be concluded that all alkalis are bases but all bases are not alkalis.

**For example:** As all alkalis are bases, so  $NaOH$  (alkali) acts also as a base and gives  $OH^-$  ions in aqueous solution. While all the bases are not alkalis.

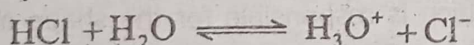


which meets criteria of base by donating electron pair or accepting proton is not an alkali as it is not water soluble and does not give  $OH^-$  in aqueous solution.

3. Define Bronsted-Lowry base and explain with an example that water is a Bronsted-Lowry base.

Ans. According to Bronsted-Lowry a base is a substance that can accept a proton from another substance.

When  $HCl$  is dissolved in water,  $H_2O$  acts as a base as it accepts proton from  $HCl$  to form hydronium ion.



So,  $HCl$  is an acid as it donates a proton, where as  $H_2O$  is a base as it accepts a proton.

4. How can you justify that Bronsted-Lowry concept of acid and base is applicable to non-aqueous solutions?

Ans. According to Bronsted-Lowry a base is a substance that can accept a proton ( $H^+$ ) from another substance while an acid is a substance that can donate a proton ( $H^+$ ) to another substance.

The compounds which have  $H^+$  ions also acts as acid in addition to water e.g.,  $HCl$  while the compound which has no  $OH^-$  ions also act as base e.g.,  $NH_3$  acts as a base according to Bronsted-Lowry concept as it can accept a proton. Its basic nature is not dependent upon aqueous medium as it has no  $OH^-$  ions to provide. For this there is no need of aqueous solution or aqueous medium. So it can be said that Bronsted-Lowry concept of acid and base is applicable to non aqueous medium.

5. Which kind of bond forms between a Lewis acid and a base?

Ans. A bond which is formed in Lewis acid and a Lewis base is co-ordinate covalent bond.



(SWL-I)(ALP)

**6. Why  $H^+$  ion acts as a Lewis acid?**

**Ans.** According to Lewis, acid is a substance which can accept a pair of electrons.  $H^+$  is an electron deficient due to its empty orbital. So it can accept a pair of electron to complete its valence shell.

**7. Name two acids used in the manufacturing of fertilizers.**

**Ans.** Sulphuric acid  $H_2SO_4$  and Nitric acid  $HNO_3$  are used in the preparation of fertilizers.

(BWP-I,MLT-I,FSD-I)(ALP)

**8. Define pH. What is the pH of pure water?**

**Ans.** pH is the negative logarithm of molar concentration of the hydrogen ions.

$$pH = -\log[H^+] \quad \text{The pH of pure water is 7.}$$

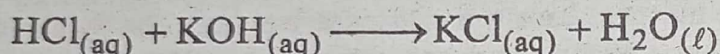
**9. How many times a solution of pH 1 will be stronger than that of a solution having pH 2?**

(BWP-II,LHR-I)(ALP)

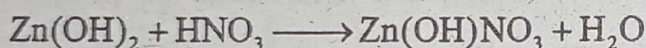
**Ans.** A solution of pH 1 has 10times higher concentration of  $[H^+]$  than that of a solution of pH 2.

**10. Define the following:****i. Normal salt****ii. Basic salt****Ans. Normal Salt:**

A salt formed by the total replacement of ionizable  $H^+$  ions of an acid by a positive metal ion or  $NH_4^+$  ions is called normal or neutral salt. These salts are neutral to litmus, that is,



**Basic Salts:** Basic salts are formed by the incomplete neutralizaiton of a polyhydroxy base by an acid.

**11.  $Na_2SO_4$  is a neutral salt while  $Na_2HSO_4$  is an acidic salt. Justify.**

**Ans.**  $Na_2SO_4$  is a salt formed by the total replacemenet of ionized  $H^+$  ions of an acid by a positive metal ion. Therefore it is called normal salt.

$NaHSO_4$  is a acidic salt because it is formed by partial replacement of a replaceable ions of an acid by a positive metal ion. This is the reason it is a acidic salt.

**12. Give a few characteristic properties of salts.****Ans. Characteristic properties of salts:**

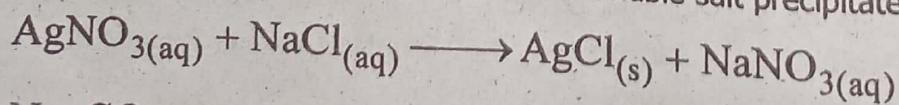
- Salts are ionic compounds found in crystalline form.
- They have high melting and boiling points.
- Most of the salts contain water of crystallization which is responsible for the shape of the crystals. For example, Copper sulphate  $CuSO_4 \cdot 5H_2O$  has 5 water of crystallization.
- Salts are neutral compounds.

**13. How the soluble salts are recovered from water?**

**Ans.** Soluble salts are often prepared in water. And they are recovered by evaporation or crystallization process.

**14. How are the insoluble salts prepared?****Ans. Preparation of insoluble salts:**

In this method, usually solutions of soluble salts are mixed. During the reaction exchange of ionic radicals (i.e., metallic radicals) takes place to produce two new salts. One of the salts is insoluble and the other is soluble. The insoluble salt precipitates (solidify in solution).





15. Why a salt is neutral, explain with an example?

Ans. Salts are neutral compounds. Although, they do not compose of equal number of positive and negative ions, but have equal number of positive and negative charges. NaCl is a neutral salt. Because  $\text{Na}^+$  is a positive ion and  $\text{Cl}^-$  is a negative charge carrier. Both charges are equal.

16. Name an acid used in preservation of food.

Ans. Benzoic acid is used for the preservation of food.

17. Name the acids present in:

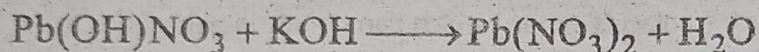
i. Vinegar      ii. Ant sting      iii. Citrus fruit      iv. Sour milk

Ans. i. Acetic acid      ii. Formic acid      iii. Citric acid      iv. Lactic acid

18. How can justify that  $\text{Pb}(\text{OH})\text{NO}_3$  is a basic salt?

Ans.  $\text{Pb}(\text{OH})\text{NO}_3$  is a basic salt as:-

- It has replaceable hydroxide ion which gives clue about basic salt.
- It undergoes neutralization process by reaction with acid.



19. You are in a need of an acidic salt. How can you prepare it?

Ans. Acidic salts are formed by partial replacement of a replaceable  $\text{H}^+$  ions by a positive metal ion.



20. Which salt is used to prepare plaster of paris?

Ans. Calcium sulphate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) is used to prepare plaster of Paris.

### Extensive Questions

1. Define pH. Write its three uses.

[RWP-GI-21][MTN-GII-21][BWP-GI-21](ALP)

Ans. pH Scale:

Concentration of hydrogen ion  $[\text{H}^+]$  in pure water is the basis for the pH scale.

$$\text{pH} = -\log[\text{H}^+]$$

Uses of pH:

- pH is used to determine acidic or basic nature of solution.
- pH is used to produce medicines, culture at a microbiological particular concentration of  $\text{H}^+$  ion.
- pH is used to prepare solutions of require concentration necessary for certain biological reactions.

2. Define salt explain with examples how soluble salts are prepared and Also write the characteristics of salts.

[DGK-GII-21][SWL-21][MTN-GI-21](ALP)

Ans. Salts: Salts are ionic compounds generally formed by the neutralization of an acid with a base. For example NaCl and  $\text{KNO}_3$ .

Salts are made up of positive ions (cations) and negative ions (anions). A cation is metallic and derived from a base, therefore, it is called basic radical. An anion is derived from acids therefore it is called acid radical.

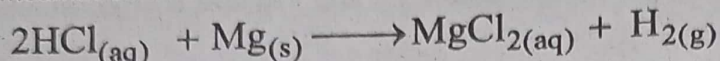
Characteristic properties of salts:

- Salts are ionic compound
- They are found in crystalline form.
- They have high Melting and boiling points.
- Salts are neutral compounds. They have equal number of positive and negative charges.

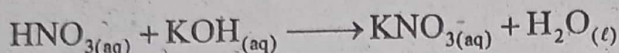


**Preparation of Soluble Salts:**

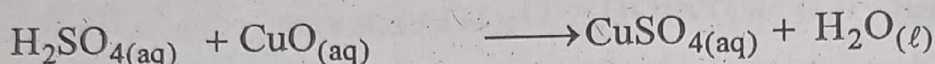
- (i) **By the reaction of an acid and a metal:** (Direct displacement method)  
This is direct displacement method in which hydrogen ion of acid is replaced by a reactive metal. Such as calcium, magnesium, Zinc and Iron, e.g.



- (ii) **By the reaction of an acid and a base:** (Neutralization method):  
It is a neutralization reaction in which acid and base react to produce a salt and water.



- (iii) **By the reaction of an acid and metallic oxide:**  
Mostly the insoluble metallic oxides react with dilute acids to form salt and water.

**3. Explain the Lewis concepts of acids and bases.**

[SGD-GII-21](ALP)

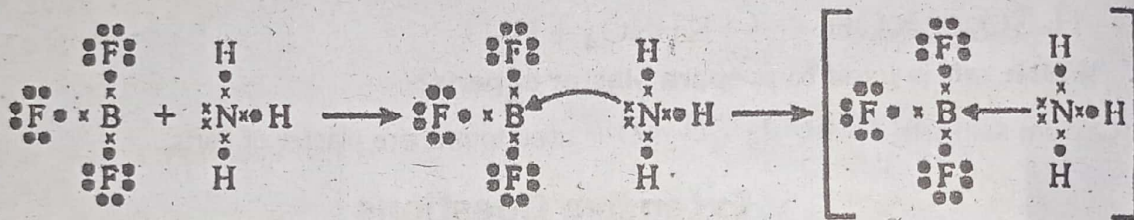
**Ans. Lewis Acid:**

An Acid is a substance (molecule or ion) which can accept a pair of electrons.

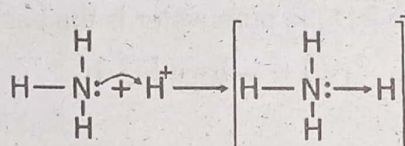
**Lewis Base:** A base is a substance (molecule or ion) which can donate a pair of electrons.

For example:  $\text{Cl}^-$ ,  $\text{OH}^-$ ,  $\text{H}_2\ddot{\text{O}}$ ,  $\ddot{\text{N}}\text{H}_3$

Example:- For example a reaction between ammonia ( $\text{NH}_3$ ) and Boron trifluoride takes place by donating an electron pair of ammonia and accepting that electron pair by boron trifluoride.



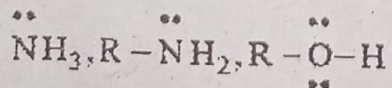
- (ii) When  $\text{H}^+$  and  $\text{NH}_3$  react together they form  $\text{NH}_4^+$  in this reaction  $\text{NH}_3$  is a base and  $\text{H}^+$  act as acid.

**Characteristics of Lewis acids:**

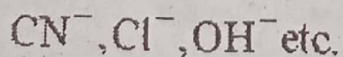
- (i) Molecules in which the central atom has incomplete octet. For example, in  $\text{BF}_3$ ,  $\text{AlCl}_3$ ,  $\text{FeCl}_3$ , the central atom has only six electrons around it, therefore, these can accept an electron pair.
- (ii) Simple cations can act as Lewis acids. All cations act as Lewis acids since they are deficient in electrons. However, cations such as  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$  ions, etc, have very little tendency to accept electrons. While the cations like  $\text{H}^+$ ,  $\text{Ag}^+$  ions, etc, have a greater electron accepting tendency therefore, act as Lewis acids.

**Characteristics of Lewis bases:**

- (i) Neutral species having at least one lone pair of electrons. For example, ammonia amines, alcohols etc., act as Lewis bases because they contain a lone pair of electrons:



- (ii) Negatively charged species or anions. For example, chloride, cyanide, hydroxide ions, etc. as Lewis bases:

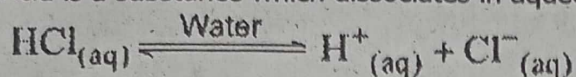




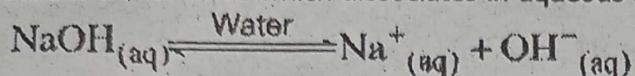
4. Describe Arrhenius concept of acids and bases, Give examples. [DGK-GI-21](ALP)

Ans. Arrhenius concept of acids:

Acid is a substance which dissociates in aqueous solutions to give hydrogen ions.



Base is a substance which dissociates in aqueous solution to give hydroxide ions.



Limitation of Arrhenius Concept:

- This concept is applicable only in aqueous medium and does not explain nature of acids and bases in non-aqueous medium.
- According to this concept, acids and bases are only those compounds which contain hydrogen ( $\text{H}^+$ ) and hydroxyl ( $\text{OH}^-$ ) ions, respectively. It can not explain the nature of compounds like  $\text{CO}_2$ ,  $\text{NH}_3$  etc, which are acid and bases, respectively.

5. Define acid and base according to Bronsted-Lowry concept and justify with examples that water is an amphoteric compounds. [GUJ-GI-21][RWP-GII-21](ALP)

Ans. Bronsted-Lowry concept:

In 1923, the Danish chemist Bronsted and the English chemist Lowry independently presented their theories of acids, bases on the basis of proton-transfer.

Acid:

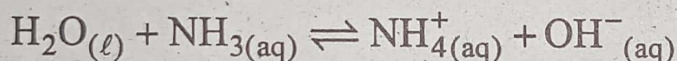
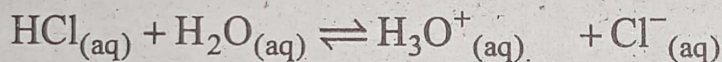
According to Bronsted-Lowry concept "An Acid is a substance (molecule or ion) that can donate a proton ( $\text{H}^+$ ) to another substance. For example  $\text{HCl}$ ,  $\text{HNO}_3$  and  $\text{CH}_3\text{COOH}$ .

Base:

A base is a substance that can accept a proton ( $\text{H}^+$ ) from another substance.

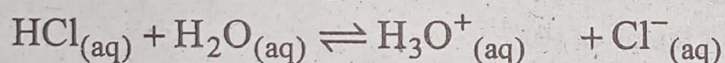
For example  $\text{H}_2\text{O}$  and  $\text{NH}_3$ .

Exaples:



**Conjugate Acid:** Conjugate acid is a species formed by acceptance of a proton ( $\text{H}^+$ ) by a base.

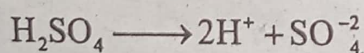
**Conjugate base:** Conjugate base is a species formed when an acid donates a proton.  $\text{OH}^-$  is conjugate base of acid  $\text{H}_2\text{O}$ .



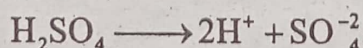
### Numericals

1. Calculate the pH and pOH of  $0.2\text{M H}_2\text{SO}_4$  ?

**Solution:** Sulphuric acid is a strong acid. It ionized completely. Its 1 mole produce two  $\text{H}^+$  ions. As shown in balanced chemical equation.



If the  $\text{H}_2\text{SO}_4$  is  $0.2\text{M}$ , then the concentration of  $\text{H}^+$  as.



$$[\text{H}_2\text{SO}_4] = 0.2\text{M}$$

$$[\text{H}^+] = 2 \times 0.2 = 0.4\text{M} = 4 \times 10^{-1}\text{M}$$

$$\text{pH} = -\log[\text{H}^+]$$

$$\text{pH} = -\log[4 \times 10^{-1}]$$



$$\text{pH} = -\log 4 - (-1) \log 10$$

$$= -0.6 + 1 = 0.4$$

We know that:

$$\text{pH} + \text{pOH} = 14$$

$$\text{pOH} = 14 - \text{pH}$$

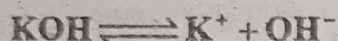
$$\text{pOH} = 14 - 0.4 = 13.6$$

2. Calculate the pH of 0.1 M KOH?

Solution:

First of all we have to find out the pOH value of 0.1 M KOH. KOH is a stronger base. It ionized completely and produce one mole of KOH produce 1 mole of ions as.

From balanced chemical equation:



So, 0.1 mole of KOH produce 0.1  $\text{OH}^-$  ions are produced.

$$[\text{OH}^-] = 0.1\text{M or } 10^{-1}\text{M}$$

We know that

$$\text{pOH} = -\log[\text{OH}^-]$$

$$\text{pOH} = -\log[10^{-1}]$$

$$\text{pOH} = 1$$

Now find out the value of pH as.

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} = 14 - \text{pOH}$$

$$\text{pH} = 14 - 1$$

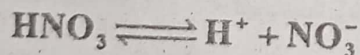
$$\text{pH} = 13$$

$$\boxed{\text{pH} = 13}$$

3. Calculate the pOH of 0.004 M  $\text{HNO}_3$ ?

Solution: First of we have to find out the pH of  $\text{HNO}_3$ .

Nitric acid is a strong acid. It ionized completely. One mole of  $\text{HNO}_3$  produce one mole of ions. As shown in balanced chemical equation.



As,  $[\text{H}^+] = 0.004\text{M or } 4 \times 10^{-3}\text{M}$

$$\text{pH} = -\log[\text{H}^+]$$

$$= -\log(4 \times 10^{-3})$$

$$= (\log 4 + \log 10^{-3})$$

$$= -\log 4 - \log 10^{-3}$$

$$= -\log 4 + 3$$

$$= 3 - \log 4$$

$$= 3 - 0.602$$

$$\text{pH} = 0.398$$

$$\boxed{\text{pH} = 2.4}$$

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Or

$$pOH = -\log[0.004]$$

$$pOH = +2.398$$

$$pOH = 2.4$$

Now find out the value of pOH as  $pH + pOH = 14$ 

$$pOH = 14 - pH$$

$$pOH = 14 - 2.398$$

$$pOH = 11.602$$

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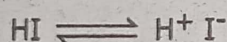
## 4. Complete the following table

|       | Solution                   | $[H^+]$             | $[OH^-]$            | pH    | pOH   |
|-------|----------------------------|---------------------|---------------------|-------|-------|
| (i)   | 0.15M HI                   | $15 \times 10^{-2}$ | —                   | 0.82  | 13.4  |
| (ii)  | 0.040M KOH                 | —                   | $4 \times 10^{-2}$  | 12.6  | 1.4   |
| (iii) | 0.020M Ba(OH) <sub>2</sub> | —                   | $4 \times 10^{-2}$  | 12.6  | 1.4   |
| (iv)  | 0.00030M HClO <sub>4</sub> | $3 \times 10^{-4}$  | —                   | 3.52  | 10.48 |
| (v)   | 0.55M NaOH                 | —                   | $55 \times 10^{-2}$ | 13.74 | 0.26  |
| (vi)  | 0.055M HCl                 | $55 \times 10^{-3}$ | —                   | 1.26  | 12.74 |
| (vii) | 0.055M Ca(OH) <sub>2</sub> | —                   | $11 \times 10^{-2}$ | 13.04 | 0.96  |

This table is completed on the basis of following calculations:

Solution:

(i) 0.15 M HI

0.15 hydrogen iodide (HI) release one  $H^+$  ion as...

$$[H^+] = 1 \times 0.15 \text{ or}$$

$$H^+ = 15 \times 10^{-2}$$

$$pH = -\log(15 \times 10^{-2})$$

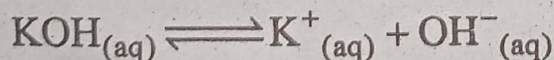
$$pH = 0.82$$

$$pOH + pH = 14$$

$$pOH = 14 - 0.82$$

$$pOH = 13.12$$

(ii) 0.040 M KOH

KOH is a strong base which can ionize completely. One mole of KOH produces one OH<sup>-</sup> ion as shown in balanced chemical equation:

$$OH^- = 1 \times 0.040$$

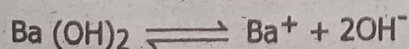
$$OH^- = 4.0 \times 10^{-2}$$

$$pOH = -\log(4.0 \times 10^{-2})$$

$$pOH = 1.40$$

$$pOH + pH = 14$$

$$pH = 14 - pOH = 14 - 1.40 = 12.60$$

(iii) 0.020 M Ba(OH)<sub>2</sub>Ba(OH)<sub>2</sub> releases two OH<sup>-</sup> ions as shown in equation

$$OH^- = 2 \times 0.020$$



$$OH^- = 4 \times 10^{-2}$$

$$pOH = -\log(OH^-)$$

$$pOH = -\log(4 \times 10^{-2})$$

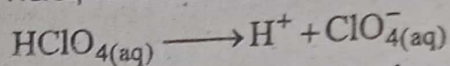
$$pOH = 1.40$$

$$pH + pOH = 14$$

$$pH = 14 - pOH = 14 - 1.40 = 12.6$$

(iv) 0.00030 M  $HClO_4$

$HClO_4$  releases one  $H^+$  ion as:



$$H^+ = 1 \times 3.0 \times 10^{-4}$$

$$H^+ = 3.0 \times 10^{-4}$$

$$pH = -\log[H^+]$$

$$pH = -\log[3.0 \times 10^{-4}]$$

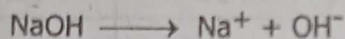
$$pH = 3.52$$

$$pOH + pH = 14$$

$$pOH = 14 - pH$$

$$pH = 14 - 3.52 = 10.48$$

(v) 0.55 M NaOH



NaOH releases one ( $OH^-$ ) ion as:

$$OH^- = 1 \times 0.55$$

$$[OH^-] = 55.0 \times 10^{-2}$$

$$pOH = -\log[OH^-]$$

$$pOH = -\log(55.0 \times 10^{-2})$$

$$pOH = 0.26$$

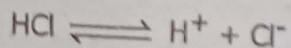
$$pH + pOH = 14$$

$$pH = 14 - pOH$$

$$pH = 14 - 0.26$$

$$pH = 13.74$$

(vi) 0.050 M HCl



HCl releases one  $H^+$  ion as.....

$$H^+ = 1 \times 0.055$$

$$H^+ = 55 \times 10^{-3}$$

$$pH = -\log[55 \times 10^{-3}] = 1.26$$

$$pH + pOH = 14$$

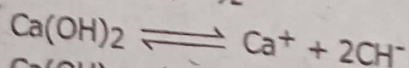
$$pH + pOH = 14$$

$$pOH = 14 - pH$$

$$pOH = 14 - 1.26$$

$$pH = 12.74$$

(vii) 0.055 M  $Ca(OH)_2$



$Ca(OH)_2$  releases two ( $OH^-$ ) ions as...

$$OH^- = 2 \times 0.055$$

$$OH^- = 0.11$$

or

$$11 \times 10^{-2}$$

$$pOH = -\log[11 \times 10^{-2}]$$

$$pOH = 0.96$$

$$pH + pOH = 14$$

$$pH = 14 - pOH$$

$$pH = 14 - 0.96 = 13.04$$

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## Chapter 11 Organic Chemistry

All Punjab Past Board Papers  
2014 - 2021

## ALP Annual Paper 2021


## MCQ's

- What is the molecular formula for butane?  
(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $C_4H_6$  (B)  $C_4H_{10}$  (C)  $C_4H_{12}$  (D)  $C_4H_8$
- Formula of Acetaldehyde is: (BWP-I)  
(A)  $CH_3-CH_2OH$  (B)  $CH_3-C-OH$  (C)  $CH_3-\overset{\overset{O}{||}}{C}-H$  (D)  $H-C-H$
- What is the formula of Octance? (GUJ-I)  
(A)  $C_3H_8$  (B)  $C_8H_{16}$  (C)  $C_8H_{18}$  (D)  $C_8H_{20}$

2014 - 2020

## 11.1

## Organic Compounds

- The example of hetrocyclic compound is: (SGD-II, MTN-I, FSD-II, DGK-II)  
(A) benzene (B) hexane (C) cyclohexane (D) Pyridine
- Benzene ring  is an exmaple of:  
(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
(A) Alicyclic compound (B) Aromatic compound  
(C) Heterocyclic compound (D) Straight chain
- The formula of Pentane is: (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $C_5H_{12}$  (B)  $C_5H_{10}$  (C)  $C_5H_8$  (D)  $C_5H_{14}$
- The Formula of Decane is: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $C_{10}H_{20}$  (B)  $C_{10}H_{22}$  (C)  $C_{10}H_8$  (D)  $C_{10}H_{16}$
- All known organic compounds have been broadly divided into categories depending upon their carbon skeleton: (SGD-I/II, DGK-II, SWL-II)  
(A) 1 (B) 2 (C) 3 (D) 4
- Open chain compounds also called: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Acyclic (B) Cyclic (C) Covalent (D) Ionic
- Open chain compounds are those in which the end carbon atoms are \_\_\_\_: (SGD-I/II, DGK-II, SWL-II)  
(A) Joined (B) One line (C) Two line (D) not joined
- Open chain compounds also called: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Aliphatic (B) Cyclic (C) Covalent (D) Ionic
- Cyclic compounds are divided into: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) 1 (B) 2 (C) 3 (D) 4
- Homocyclic compounds are devided into: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) 2 (B) 4 (C) 6 (D) 8
- Cyclobutane is an example of: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Alicyclic (B) Heterocyclic (C) Aromatic compounds (D) Covalent



15. Benzene ring consist of carbon atoms: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) 2 (B) 3 (C) 5 (D) 6
16. Cyclic compounds that contain one or more atoms other than that of carbon atoms in their rings are called \_\_\_\_\_: (SGD-I/II, DGK-II, SWL-II)  
 (A) Alicyclic (B) Heterocyclic (C) Aromatic compounds (D) Covalent

## 11.2

## Sources of Organic Compounds

17. How many percent of natural gas is consisted of . [GUJ-I, MTN-II, DGK-I, SWL-I]  
 (A) 82% (B) 83% (C) 84% (D) 85%
18. Wood contains the amount of carbon: [LHR-II, RWP-II, SGD-I, MTN-I, FSD-II, SWL-II]  
 (A) 40% (B) 50% (C) 60% (D) 70%
19. Main component of Natural Gas is: [GUJ-II, FSD-II, DGK-I, MTN-II, BWP-II]  
 (A) Methane (B) Propane (C) Butane (D) Propyne

## 11.3

## Uses of Organic Compounds

## 11.4

## Alkanes and Alkyl Radicals

## 11.5

## Functional Groups

## 11.6

## Functional Groups Test

20. Formula of alkyl radical is: [MTN-II, DGK-I/II, FSD-II]  
 (A)  $C_nH_{2n+2}$  (B)  $C_nH_{2n-2}$  (C)  $C_nH_{2n+1}$  (D)  $C_nH_{2n-1}$
21. Organic compounds are divided into groups of compounds having similar chemical properties. This group is known as: (SGD-I/II, DGK-II, SWL-II)  
 (A) Organic series (B) saturated compound  
 (C) Homologous series (D) Hetrologous series
22. The general formula of alkane is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $C_nH_{2n+2}$  (B)  $C_nH_{2n+1}$  (C)  $C_nH_{2n}$  (D)  $C_nH_{2n-2}$
23. The general formula of alkene is: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A)  $C_nH_{2n+2}$  (B)  $C_nH_{2n+1}$  (C)  $C_nH_{2n}$  (D)  $C_nH_{2n-2}$
24. The general formula of alkynes is: (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A)  $C_nH_{2n+2}$  (B)  $C_nH_{2n+1}$  (C)  $C_nH_{2n}$  (D)  $C_nH_{2n-2}$
25. Which one is carboxylic group? (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $\text{C}=\text{O}$  (B)  $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{OH} \end{array}$  (C)  $\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{OH} \end{array}$  (D)  $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{H} \end{array}$
26. Class formula of primary alcohol is: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A)  $\text{R}-\text{CH}_2-\text{OH}$  (B)  $\begin{array}{c} \text{R} \\ \diagup \\ \text{CH}-\text{OH} \\ \diagdown \\ \text{R} \end{array}$  (C)  $\begin{array}{c} \text{R} \\ | \\ \text{R}-\text{C}-\text{OH} \\ | \\ \text{R} \end{array}$  (D)  $\text{R}-\text{O}-\text{R}$
27. Functional group of alcohols is: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A)  $-\text{COOH}$  (B)  $>\text{C}=\text{O}$  (C)  $\text{C}-\text{O}-\text{C}$  (D)  $-\text{OH}$



28. Which one of the following compounds is ketone? (SGD-I/II, DGK-II, SWL-II)  
 (A)  $(CH_3)_2CHOH$  (B)  $(CH_3)_2CO$  (C)  $(CH_3)_2NH$  (D)  $(CH_3)_2CHCl$
29. Class formula of tertiary alcohol is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $R-O-R$  (B)  $\begin{array}{c} R \\ | \\ R-C-OH \\ | \\ R \end{array}$  (C)  $\begin{array}{c} R \\ / \\ CH-OH \\ \backslash \\ R \end{array}$  (D)  $R-CH_2-OH$
30. Test for unsaturation is: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A) Sodium metal test (B) Baeyer's test  
 (C) Bromine test (D) Ester test

### Answers

|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | B | 2  | C | 3  | C | 4  | D | 5  | B | 6  | A | 7  | B | 8  | B | 9  | A | 10 | D |
| 11 | A | 12 | B | 13 | A | 14 | A | 15 | D | 16 | B | 17 | D | 18 | A | 19 | A | 20 | C |
| 21 | C | 22 | A | 23 | C | 24 | D | 25 | B | 26 | A | 27 | D | 28 | B | 29 | B | 30 | C |

### ALP Annual Paper 2021

#### Short Questions

1. Define structural formula. (BWP-GI, SWL-GII, GUJ-GI, GII, MTN-GI)  
**Ans: Structural Formula:** Structural formula of a compound represents the exact arrangement of the different atoms of various elements present in a molecule of a substance.  
**Example:**
- $$\begin{array}{ccccccc} & H & & H & & H & & H \\ & | & & | & & | & & | \\ H & -C & - & C & - & C & - & C-H \\ & | & & | & & | & & | \\ & H & & H & & H & & H \end{array}$$

*n-Butane*
2. Define organic chemistry. (DGK-GI, SGD-GI, DGK-GI)  
**Ans:** The branch of chemistry which deals with the study of hydrocarbons and their derivatives is known as organic chemistry.
3. Define condensed formula with an example. (LHR-I/II, MUL-I, SGD-II, DGK-I/II, SWL-I/II)  
**Ans: Condensed formula:** The formula that indicates the groups of atoms joined together to each carbon atom in a straight chain or a branched chain is called the condensed formula.  
**Example:** Butane  $CH_3(CH_2)_2CH_3$
4. Define molecular formula and write the formula of hexane. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-I)

#### Ans. Molecular Formula:

The formula which represents the actual number of atoms in one molecule of organic compound is called molecular formula.

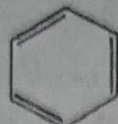
**Example:** Molecular formula of butane is  $C_4H_{10}$ .

5. What are Aromatic Compounds? Give an example. (FSD-GI, II, MTN-GII, SDG-GI, DGK-GI, BWP-GII)

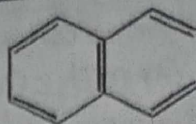
**Ans: Aromatic compounds:** These organic compounds contain at least one benzene ring in their molecule. A benzene ring is made up of six carbon atoms with three alternating double bonds. They are called aromatic because of aroma or smell they have.



For example:



Benzene



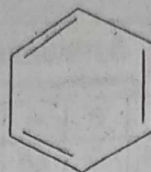
Naphthalene

6. What are closed chain compounds? Give an example.

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans: Closed chain or cyclic compounds: Closed chain or cyclic compounds contain one or more closed chains, i.e. the carbon atoms at the end of the chain are not free.

Example:



Benzene

7. Define open chain or acyclic compounds.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Open chain or acyclic compounds:

These compounds contain open chains of carbon atoms in their molecules.

Examples:  $\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

Straight chain (n-Butane)

8. Write any two properties of homologous series.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans:

- All members of a series have same functional group and same chemical properties.
- Successive members of the series differ by one unit of  $-\text{CH}_2-$  and 14 units in their relative molecular mass.

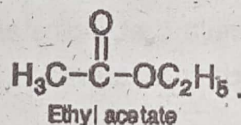
9. What is ester linkage? write formula of ethyl acetate.

(BWP-I, LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Ester Linkage: Organic compounds consisting of  $\text{RCOOR}'$  functional group are called

esters. Their general formula is  $\text{R}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{OR}'$ . R and R' are alkyl groups.

Formula of Ethyl acetate:



10. What is alcoholic functional group. Give examples

(LHR-GI, RWP-GI, SWL-GI)

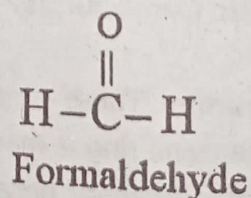
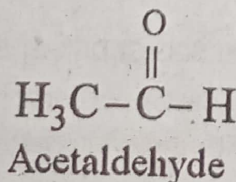
Ans: Alcoholic Functional Group: The functional group of alcohol is  $-\text{OH}$ , their general formula is  $\text{ROH}$ . Where R is an alkyl group.

For example  $\text{CH}_3\text{OH}$  (Methyl alcohol)

11. Give formulae of Formaldehyde and Acetaldehyde.

(LHR-I/II, MUL-I, SGD-I/II, DGK-I/II, SWL-I/II)

Ans:

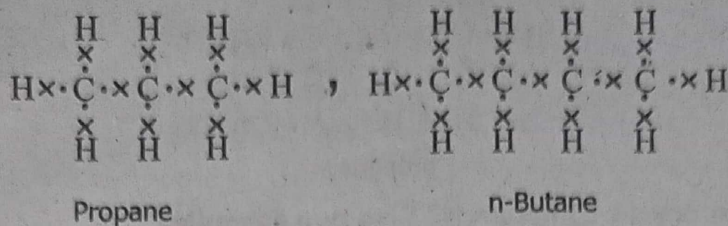




12. Write down the dot and cross formula of propane and n Butane.

[FSD-II,DGK-I,BWP-II,SWL-I/II]

**Ans:**



13. Give two examples of open chain organic compounds. [MTN-II, FSD-II, DGK-I, SWL-IGUJ-I]

**Ans:** Ethane, Propane

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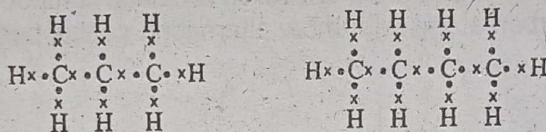
## 11.1

## Organic Compounds, Classification of Organic Compounds

**14. What is Electronic or Dot and Cross formula?**

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans:** A formula that shows all the shared as well as the unshared electrons by dot (.) or cross (x) is called an electronic formula.

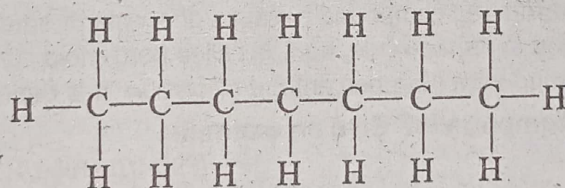


15. Give the condensed and structural formulas of  $C_7H_{16}$ .

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans. Condensed formulae of  $C_7H_{16}$ :  $H_3C(CH_2)_5CH_3$

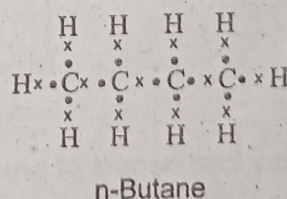
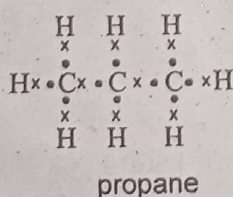
**Structural formulas of  $C_7H_{16}$  :**



**16. Write down the Dot and Cross Formula of Propane and n-Butane.**

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans.**



**17. Define Dot and Cross Formula. Also write Dot and Cross Formula of Propane.**

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans.** A formula that shows all the shared as well as the unshared electrons by dot (.) or cross (x)



31. Explain Carboxyl Group? Give one example. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Carboxyl Group: Compounds containing functional group  $\text{—}\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{—OH}$  are called carboxylic acids. Their general formula is  $\text{R—}\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{—OH}$

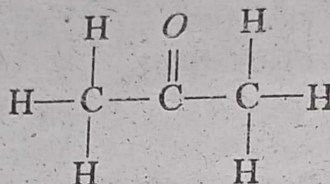
Example:  $\text{H—}\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{—OH}$   
Formic acid

32. Write formula of methyl acetate and Ethyl acetate. (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

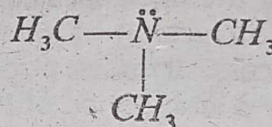
Ans:  $\text{H}_3\text{C—}\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{—O—CH}_3$  Methyl acetate  
 $\text{H}_3\text{C—}\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{—O—C}_2\text{H}_5$  Ethyl acetate

33. Write down the structural formulae of acetone and trimethylamine. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans. structural formulae of acetone:



structural formulae of trimethylamine:



34. Write a test for unsaturation of organic compounds. [LHR-II, FSD-II, RWP-II, RUJ-II, SWL-II]

Ans: Bromine water test: Use the given organic compound in small quantity upto  $2.0\text{cm}^3$  and dissolve in carbon tetrachloride ( $\text{CCl}_4$ ). Add to  $2\text{cm}^3$  of bromine water and shake it well.

Result: The colour of the bromine will vanish (disappear).

## Solved Exercise

### Multiple Choice Questions

- The ability of carbon atoms to form chains is called:  
(a) isomerism (b) catenation (c) resonance (d) condensation.
- Coal having 90% carbon contents is called:  
(a) peat (b) lignite (c) anthracite (d) bituminous
- Main component of natural gas is:  
(a) methane (b) propane (c) butane (d) propane
- The strong heating of coal in retorts in the absence of air is called:  
(a) Fractional distillation (b) sublimation  
(c) roasting (d) destructive distillation
- Pitch is black residue of:  
(a) Coke (b) Coal-tar (c) carbon black (d) coal gas
- Natural gas is 85% methane. It is used to make the following except:  
(a) carbon black (b) coke (c) coal tar (d) coal gas
- Which one of the following does not contain starch?  
(a) sugar cane (b) maize (c) barley (d) potatoes
- Petroleum is refined by:  
(a) destructive distillation (b) fractional distillation  
(c) simple distillation (d) dry distillation



9. In laboratory urea was prepared by:  
 (a) Wholer (b) Rutherford (c) Berzellius (d) Dalton
10. General formula of alkyl radical is: (GUJ-I, DGK-I, MLT-I, SRG-II)(ALP)  
 (a)  $C_nH_{2n+2}$  (b)  $C_nH_{2n-2}$  (c)  $C_nH_{2n+1}$  (d)  $C_nH_{2n}$
11. Identify which one of the following compounds is a ketone: (MLT-II)(ALP)  
 (a)  $(CH_3)_2CHOH$  (b)  $(CH_3)_2CO$  (c)  $(CH_3)_2NH$  (d)  $(CH_3)_2CHCl$
12. The functional group-COOH is found in: (DGK-II, FSD-I, LHR-I)(ALP)  
 (a) carboxylic acid (b) aldehydes (c) alcohols (d) ester
13. Which one of the following statements is not true about fossil fuels?  
 (a) they all contain carbon (b) they are renewable  
 (c) they produce pollutants when (d) they cause acid rain
14. Which one of the following is the hardest coal?  
 (a) peat (b) lignite (c) bituminous (d) anthracite
15. In which of the following groups, oxygen is attached on both sides with carbon atoms? (RWP-I)(ALP)  
 (a) ketone (b) ether (c) aldehyde (d) ester
16. Carbonization process is the conversion of:  
 (a) coal into coal gas (b) coal into wood  
 (c) Wood into coal (d) wood into coal tar
17. Coal gas is a mixture of:  
 (a) CO and  $CH_4$  (b) CO,  $CH_4$ ,  $CO_2$   
 (c) CO,  $CH_4$ ,  $CH_2$  (d) CO,  $H_2$  and  $CO_2$
18. Which one of the following is a synthetic fiber?  
 (a) cotton (b) wool (c) nylon (d) petroleum
19. Which one of the following does not contain protein.  
 (a) coal (b) natural gas (c) biogas (d) petroleum
20. Which one of the following does not contain protein.  
 (a) pulse (b) potatoes (c) beans (d) eggs
21. Conversion of dead plant into coal by the action of bacteria and heat is called:  
 (a) carbonization (b) catenation (c) hydrogenation (d) cracking
22. Which one of the following compounds is an aldehyde? (RWP-II, SWL-I)(ALP)  
 (a)  $CH_3 - CH_2 - OH$  (b)  $CH_3 - COOH$  (c)  $CH_3CHO$  (d)  $CH_3COCH_3$
23. Formula of acetaldehyde is:  
 (a)  $CH_3 - CH_2OH$  (b)  $CH_3 - \overset{\overset{O}{\parallel}}{C} - OH - OH$  (c)  $CH_3 - \overset{\overset{O}{\parallel}}{C} - H$  (d)  $H - \overset{\overset{O}{\parallel}}{C} - H$

### Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | b | 2  | c | 3  | a | 4  | d | 5  | B |
| 6  | c | 7  | a | 8  | b | 9  | a | 10 | C |
| 11 | b | 12 | a | 13 | b | 14 | d | 15 | B |
| 16 | c | 17 | c | 18 | c | 19 | c | 20 | B |
| 21 | a | 22 | c | 23 | c |    |   |    |   |

### Short Questions

1. What is meant by the term catenation? Give an example of a compound that displays catenation?

Ans. The ability of carbon atoms to link with other carbon atoms to form chains and large rings is called catenation. Carbon is a compound which displays catenation.

#### Basic conditions for catenation:

Two basic conditions for an element of exhibit catenation are:

- (a) Element should have valency two or greater than two.



- (b) Bonds made by an element with its own atoms should be stronger than the bonds made by the element with other atoms especially oxygen.

**2. How coal is formed?**

**Ans.** Coal is formed by the decomposition of dead plants buried under the Earth's crust millions of years ago. Conversion of wood into coal is called carbonization. It is very slow bio-chemical process. It takes place in the absence of air under high pressure and high temperature over a long period of time (about 500 millions of years).

**3. What is importance of natural gas?**

- Ans.** i) Natural gas is used as fuel in homes as well as in industries.  
ii) It is used as fuel in automobiles as compressed natural gas (CNG).  
iii) Natural gas is also used to make carbon black and fertilizer.

**4. Justify that organic compounds are used as food.**

**Ans.** Organic compounds include carbohydrates, proteins, lipids, enzymes, vitamins, these are the components which we take in the form of food to get energy to perform different activities. Organic compounds are prepared naturally by animals and plants.

**5. How alkyl radicals are formed? Explain with examples.**

**Ans: Formation of Alkyl Radicals:**

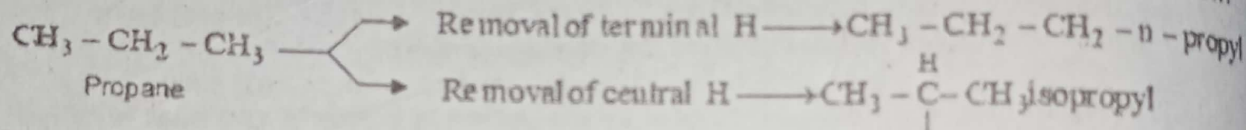
Alkyl radicals are derivatives of alkanes. They are formed by the removal of one of the hydrogen atoms of an alkane and are represented by a letter 'R'. Their name is written by replacing "ane" of alkane with 'yl'. Their general formula is  $C_nH_{2n+1}$ .

**Example:** Molecular formula of methane is  $CH_4$ . Its alkyl radical is  $CH_3 -$  (methyl).

**6. What is the difference between n-propyl and isopropyl? Explain with structure.**

(DGK-I)(ALP)

**Ans.** Propane has a straight chain structure. When terminal H is removed, it is called n-propyl. When hydrogen from central carbon is removed, it is called isopropyl, as explained below:

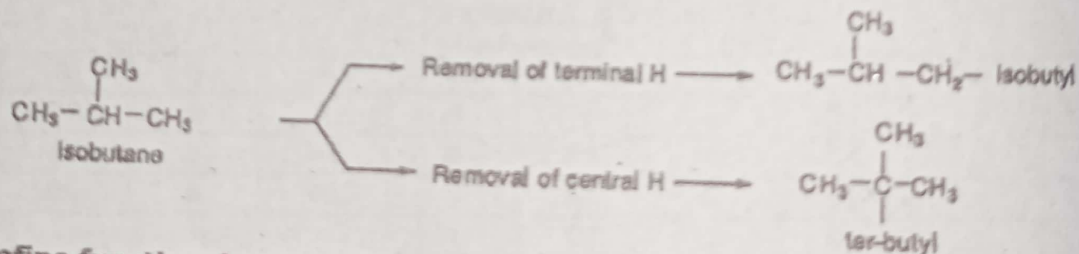
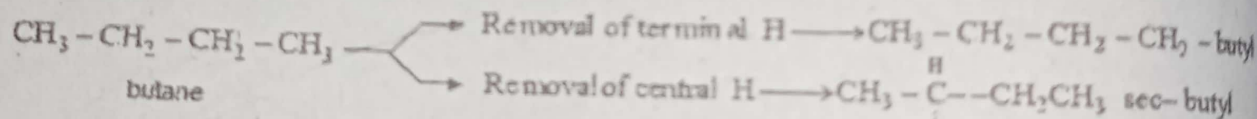


**7. Explain different radicals of butane'**

(GUJ-I, MLT-II)(ALP)

**Ans. Radicals of butane are given as:**

The radicals of butanes are formed as:



**8. Define functional group with an example.**

**Ans. Functional groups:**

An atom or group of atoms or presence of double or triple bond which determines the characteristic properties of an organic compound is known as the functional group. Functional group of alcohol is  $OH^-$ .

**9. What is an ester group? Write down the formula of ethyl acetate.**

(SWL-I)(ALP)

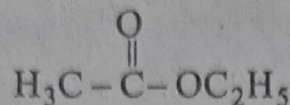
**Ans.** Organic compounds consisting  $RCOOR'$  functional group are called esters.



Their general formula is 
$$\text{R} - \overset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{OR}'$$

Where R and R' are alkyl groups. They may be same or different.

Formula of ethyl acetate:

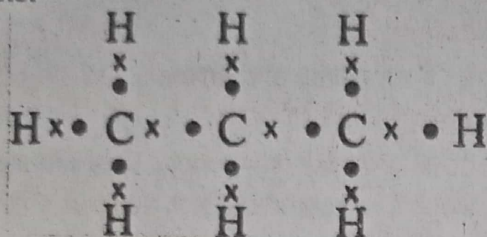


Ethyl acetate

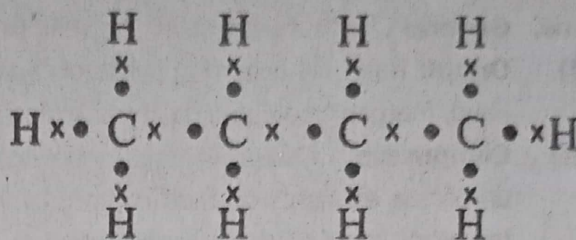
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10. Write down the dot and cross formula of propane and n-butane?

Ans.



Propane



n-butane

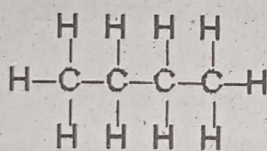
11: Define structural formula. Draw the structural formula of n-butane and isobutene. (FSD-I)(ALP)

Ans. **Structural Formula:** Formula which represents the exact arrangement of different atoms of various elements present in a molecule of a substance is called structural Formula.

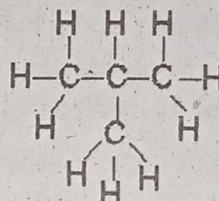
In a structural formula, single bond is represented by a single line (-), a double bond by two lines (=) and a triple bond by three lines between the bonded atoms.

Organic compounds may have same molecular formulae but different structural formula, e.g.

**Structural formula of butane  $\text{C}_4\text{H}_{10}$  are:**



n-Butane



iso-butane

12. Write classification of coal.

Ans. Depending upon the carbonization process, four types of coal are found. These types differ with respect to carbon content, volatile matter and moisture.

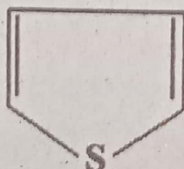
- i. **Peat:** It contains 60% of carbon contents. It is inferior quality coal used in kiln.
- ii. **Lignite:** It contains 70% of carbon contents. It is soft coal, used in thermal power station.
- iii. **Bituminous:** It contains 80% of carbon contents. It is common variety of coal used as house hold coal.
- iv. **Anthracite:** It contains 90% of carbon contents. It is superior quality hard coal that is used in industry.

13. What are heterocyclic compounds? Give two examples.

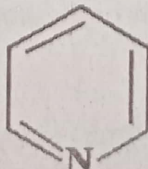
Ans. **Heterocyclic compounds:**

Cyclic compounds that contain one or more atoms other than that of carbon atoms in their rings are called heterocyclic compounds.

Examples:



Thiophene



Pyridine



14. Why benzene and other homologous compounds of benzene are called aromatic compounds?

Ans. As these organic compounds contain at least one benzene ring in their molecules, so these are called aromatic compounds. A benzene ring is made up of six carbon atoms with three alternating double bonds. Another reason for being aromatic is because of the aroma or smell they have.

Example: Benzene, Naphthalene

### Extensive Questions

1. Write characteristics of organic compounds.

Ans. **General Characteristics of Organic Compounds:**

- (i) **Origin:** Naturally occurring substances are obtained from plants and animals. On the other hand, inorganic compounds are obtained from minerals and rocks.
- (ii) **Composition:** Carbon is an essential constituent of all organic compounds. They are made up of few elements such as carbon, hydrogen, nitrogen, oxygen, halogen, sulphur etc. On the other hand, inorganic compounds are made up of almost all the elements of the periodic table known so far.
- (iii) **Covalent linkage:** Organic compounds contain covalent bonds, that may be polar or non-polar, while the inorganic compounds mostly contain ionic bonds.
- (iv) **Solubility:** Organic compounds having non-polar linkages are generally soluble in organic solvents like alcohol, ether, benzene, carbon disulphide etc. On the other hand, the inorganic compounds with ionic bonds are soluble in polar solvents like water.

2. Explain homologous series.

[DGK-GII-21][BWP-GI-21](ALP)

Ans. **Homologous series:** Organic compounds are divided into groups of compounds having similar chemical properties. Each group is known as a homologous series.

**Characteristics of homologous series:**

- i. **General formula:** All members of a series can be represented by a general formula for example, general formula of alkanes, alkenes and alkynes are  $C_nH_{2n+2}$ ,  $C_nH_{2n}$  and  $C_nH_{2n-2}$  respectively.
- ii. They can be prepared by similar general methods.
- iii. They have similar chemical properties (because they contain the same functional group).
- iv. Successive members of the series differ by one unit of  $-CH_2-$  and 14 units in their relative molecular mass.
- v. There is a regular change in their physical properties; the melting and boiling point increase gradually with the increase of molecular masses.

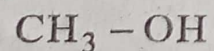
3. Define functional group. Write a note on any four functional groups.

[SWL-21][RWP-GII-21][DGK-GI-21][MTN-GI-21][GUJ-GI-21](ALP)

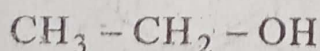
Ans. **Functional groups:** An atom or group of atoms or presence of double or triple bond which determines the characteristic properties of an organic compound is known as the functional group.

(a) **Alcoholic Group:** The functional group of alcohols is  $-OH$ . Their general formula is  $ROH$ . Where R is any alkyl group.

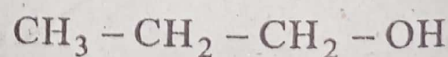
Example:



Methyl alcohol



Ethyl alcohol



n-Propyl alcohol



(b) **Ether Linkage:** The functional group of ether is C-O-C. Their general formula is  $R-O-R'$

Where R and  $R'$  are alkyl groups.

R and  $R'$  may be same or different.

**Examples:**

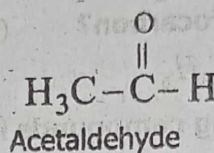
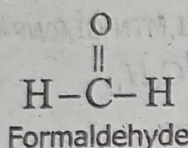
- i.  $H_3C-O-CH_3$  Dimethyl ether
- ii.  $C_2H_5-O-C_2H_5$  diethyl ether
- iii.  $H_3C-O-C_2H_5$  Ethyl methyl ether

**Aldehydic Group:**

Aldehyde family consists of functional group  $\begin{array}{c} O \\ || \\ -C-H \end{array}$  Their general formula is RCHO.

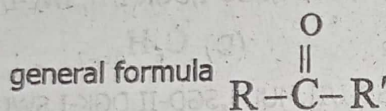
Where R stands for H or some alkyl group.

**Examples:**



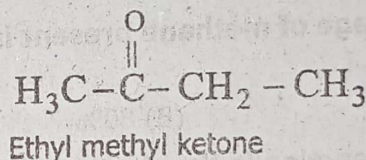
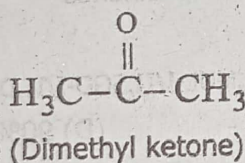
(iv) **Ketonic Group:**

Compounds containing the functional group  $\begin{array}{c} O \\ || \\ C \end{array}$  are called ketones. They have the



Where R and  $R'$  are alkyl groups. They may be same or different.

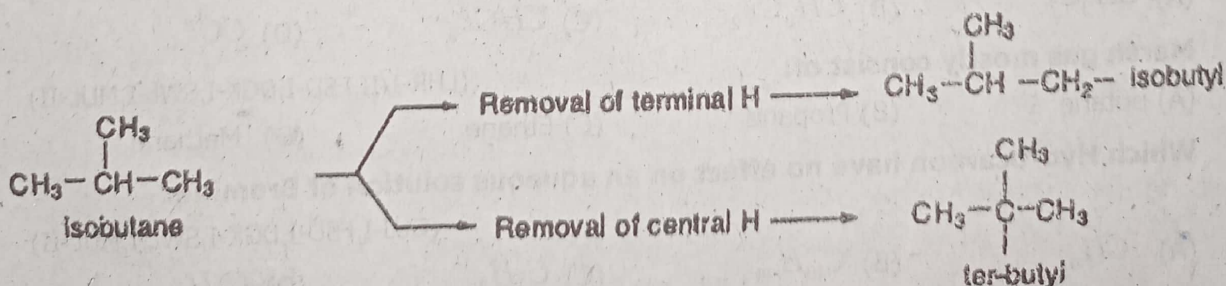
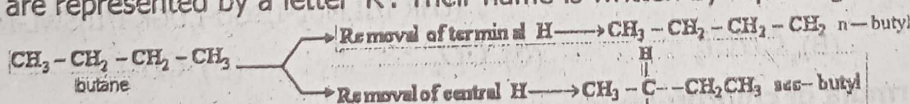
**Examples:**



4. **How alkyl radicals are formed? Write alkyl radicals of Butane.** [MTN-GII-21](ALP)

**Ans: Formation of alkyl Radicals:**

Alkyl Radicals are formed by the removal of one of the hydrogen atom of an alkanes and are represented by a letter 'R'. Their name is written by replacing 'ane' of alkanes with 'yl'.





## Chapter

12

## Hydrocarbons

ALP Annual Paper 2021

## MCQ's

1. The general formula of saturated hydrocarbons is:  
(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A)  $C_nH_{2n-2}$  (B)  $C_nH_{2n+2}$  (C)  $C_nH_{2n}$  (D)  $C_nH_n$
2. Which one of the following is an unsaturated hydrocarbons:  
(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $CH_4$  (B)  $C_2H_6$  (C)  $C_2H_4$  (D)  $C_3H_8$

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## 12.1

## Alkanes

3. Which is a saturated hydrocarbon? (GUJ-GI,II, SGD-GI, GII, FSD-GI,II, MTN-GI, RWP-GI)  
(A)  $C_2H_4$  (B)  $C_3H_6$  (C)  $C_4H_8$  (D)  $C_5H_{12}$
4. Which one of the following compounds is a saturated hydrocarbon:  
(GUJ-I/II,, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Methane (B) Ethyne (C) Propene (D) Propyne
5. General formula of alkanes is:  
(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A)  $C_nH_{2n}$  (B)  $C_nH_{2n+1}$  (C)  $C_nH_{2n+2}$  (D)  $C_nH_{2n-2}$
6. Which is a substitution reaction? (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
(A) Halogenation of alkynes (B) Halogenation of alkenes  
(C) Halogenation of alkanes (D) Bromination of alkenes
7. Percentage of methane present in natural gas is:  
(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) 75% (B) 80% (C) 85% (D) 90%
8. Which reaction is the characteristic property of alkanes:  
(GUJ-I/II,, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Substitution reaction (B) Oxidation Reaction  
(C) Reduction Reaction (D) Addition Reaction
9. Which one of the following compounds is not produced by the halogenation methane?  
(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A)  $CCl_4$  (B)  $CHCl_3$  (C)  $CO_2$  (D)  $CH_3Cl$
10. The chemical formula of chloroform is:  
(RWP-GII, GUJ-GII, MTN-GI)  
(A)  $CH_3Cl$  (B)  $CH_2Cl_2$  (C)  $CHCl_3$  (D)  $CCl_4$
11. Marsh gas mostly consist of:  
(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) butane (B) Propane (C) Ethane (D) Methane
12. Which Hydrocarbon have no effect on an aqueous solution of Bromine:  
(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
(A)  $CH_4$  (B)  $C_{10}H_{20}$  (C)  $C_2H_2$  (D)  $C_2H_4$



13. Alkanes are also known as: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) Halogens (B) Paraffins (C) Olefins (D) Acetylenes
14. Which one of following is called paraffins? (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A) alkanes (B) alkenes (C) alkynes (D) alcohol
15. Which is used as dry cleaning? (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $CCl_4$  (B)  $CHCl_3$  (C)  $CH_4$  (D)  $CH_2Cl_2$
16. Incomplete combustion of alkanes produces. (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A) Carbon dioxide only (B) Carbon monoxide only  
 (C) Carbon monoxide and carbon black (D) Carbon dioxide and carbon black
17. Molecular formula of butane is: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A)  $C_4H_8$  (B)  $C_4H_{10}$  (C)  $C_4H_{12}$  (D)  $C_4H_6$

## 12.2

## Alkenes

18. Which one is also called "Olefins"? (LHR-GI, GUJ-GI)  
 (A) alkanes (B) alkenes (C) alkynes (D) alcohols
19. Oxidation of alkenes produces: (GUJ-GI, SGD-GII, LHR-GII, FSD-GI, BWP-GI)  
 (A) Glyoxal (B) Oxalic acid (C) Formic acid (D) Glycol
20. The order of reactivity of hydrogen halides with alkenes is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $HI > HBr$  (B)  $HBr > HI$  (C)  $HCl > HBr$  (D)  $HBr < HCl$
21. Alkenes are also known as: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A) methane (B) paraffins (C) olefins (D) acetylenes
22. Catalyst used for hydrogenation of vegetable oil is: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) Al (B) Ni (C) Co (D) Pt

## 12.3

## Alkynes

23. Benzene is formed by the polymerization of: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) Methane (B) Acetylene (C) Ethene (D) Butene
24. General formula of alkynes is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $C_nH_{2n-2}$  (B)  $C_nH_{2n+2}$  (C)  $C_nH_{2n+1}$  (D)  $C_nH_{2n}$
25. Alkynes are also called: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A) Olefins (B) Ethene (C) Paraffins (D) Acetylenes
26. The End Product of Oxidation of Acetylene is: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A) Oxalic Acid (B) Glycol (C) Glyoxal (D) Potassium Hydroxide
27. About \_\_\_\_\_ % traces of acetylene are present in coal gas. (SGD-I/II, DGK-II, SWL-II)  
 (A) 0.06 (B) 0.07 (C) 0.08 (D) 0.09



## Answers

|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |  |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|--|
| 1  | B | 2  | C | 3  | D | 4  | A | 5  | C | 6  | C | 7  | C | 8  | A | 9  | C | 10 |  |
| 11 | D | 12 | A | 13 | B | 14 | A | 15 | A | 16 | C | 17 | B | 18 | B | 19 | D | 20 |  |
| 21 | C | 22 | B | 23 | B | 24 | A | 25 | D | 26 | A | 27 | A |    |   |    |   |    |  |

## ALP Annual Paper 2021

## Short Questions

1. Why are the alkanes called paraffins?

(GUJ-GII, SWL-GGII, DGK-GI, FSD-GI, BWP-GI)

Ans: In alkanes, all the bonds of carbon atoms are single that means valencies of carbon atoms are fully satisfied (saturated). Therefore they are least reactive. That is the reason, alkanes are called paraffins (para means less, and affins means affinity or reactivity).

(LHR-GI)(RWP-GII)(DGK-GII, SWL-GII)

2. Write down two uses of ethane.

Ans: Uses of ethane:

- Natural gas is mixture of methane and ethane. It is used as domestic fuel.
- Compressed natural gas (CNG) is used as automobile fuel.
- It is used for manufacturing carbon black, methyl alcohol, chloroform, carbon tetrachloride, formaldehyde and acetaldehyde.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

3. Write two uses of ethene.

Ans: Uses of Ethene (Ethylene): (i) Ethene is used for artificial ripening of fruits.

(ii) Ethene is used as a general anaesthetic.

4. How Halogenation take place in Alkenes? Give its chemical equation.

(MTN-GII, DGK-GII)

Ans: Halogenation of alkenes is carried out by the addition of halogen like chlorine or bromine. Bromination of alkenes is very important reaction. When bromine water (a solution of bromine in water having red-brown colour) is added to ethene in an inert solvent like carbon tetrachloride its colour is discharged at once.

Equation:  $\text{H}_2\text{C}=\text{CH}_2 + \text{Br}_2 \longrightarrow \text{Br}-\text{CH}_2-\text{CH}_2-\text{Br}$

5. Which reaction is used to identify the unsaturation of an organic compound?

(SGD-I/II, DGK-II, SWL-II)

Ans: When bromine water (a solution of bromine in water having red-brown colour) is added to ethene in an inert solvent like carbon tetrachloride, its colour is discharged at once. Ethane does not react with bromine water.

Equation:  $\text{H}_2\text{C}=\text{CH}_2 + \text{Br}_2 \xrightarrow{\text{CCl}_4} \text{Br}-\text{CH}_2-\text{CH}_2-\text{Br}$

$\text{H}_3\text{C}-\text{CH}_3 + \text{Br}_2 \longrightarrow \text{No Reaction}$

In the reaction double bond of ethene is converted into a single bond by the addition of a molecule of bromine. This reaction is used to identify the unsaturation of an organic compound.

6. Why alkenes are reactive?

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans: Alkenes are reactive compounds because the electrons of the double bond are easily available for reaction. These compounds have the tendency to react readily by adding other atoms, to become saturated compounds. As a result, the double bond is converted into a single bond that is more stable.



### 7. Write two physical properties of alkynes.

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: i. Alkynes are Insoluble in water but soluble in non polar solvents like Benzene, alcohol.

ii. Alkynes are also flammable. They produce smokier flames than those of alkanes and alkenes.

### 8. Write the general formulae of alkenes and alkynes.

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans. Alkenes general formula  $C_nH_{2n+2}$  and Alkynes general formula  $C_nH_{2n-2}$ .

### 9. Why the Alkynes are called Acetylene?

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II, LHR-I)

Ans: Alkynes are also called acetylenes because of the name of the first member of this series is acetylene.

### 10. Define hydrocarbons. Give an example.

(DGK-I)

Ans: The compounds which are made up of only carbon and hydrogen are called hydrocarbons.

Example: Butane

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## 12.1

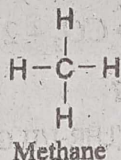
## Alkanes

### 11. What are saturated hydrocarbons. Give example.

(LHR-GI, RWP-GI, II, BWP-GI)

Ans: **Saturated Hydrocarbons:** The hydrocarbons in which all the four valencies of carbon atoms are fully satisfied (saturated) by single bonds with other carbon atoms and hydrogen atoms are called saturated hydrocarbons.

Example.



### 12. Differentiate between Saturated and Unsaturated Hydrocarbons.

(MTN-GI, RWP-GI, LHR-GII, GUJ-GII, MTN-GI)

Ans:

| Saturated Hydrocarbon  | Unsaturated Hydrocarbon   |
|--|---|
| (i) The hydrocarbons in which all the four valencies of carbon atoms are fully satisfied by single bonds with other carbon atoms and hydrogen atoms are called saturated hydrocarbons. | (i) The hydrocarbons in which two carbon atoms are linked by a double or a triple bond are called unsaturated hydrocarbons. |
| (ii) These are called alkanes with general formula $C_nH_{2n+2}$   | (ii) These are called alkenes and alkynes having general formula $C_nH_{2n}$ and $C_nH_{2n-2}$ respectively.                |
| (iii) Example: $CH_4$  | (iii) Examples: $C_2H_4$ , $C_2H_2$   |

### 13. Why are hydrocarbons considered as parent organic compounds?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: **Hydrocarbons considered as parent organic compounds:-**

Hydrocarbons are considered as parent organic compounds since other organic compounds are considered to be derived from them by the replacement of one or more hydrogen atoms by other atoms or group of atoms.



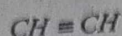
14. Write down the name of any two unsaturated hydrocarbons.

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans:



Ethene



Ethyne

15. Write condensed and dot and cross formula of ethyne.

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans. Condense formula of ethyne is  $HC \equiv CH$ .

Dot and cross formula of ethyne is  $H \times C \times \vdots C \times H$ .

16. Define Unsaturated Hydrocarbons with general formula.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: **Unsaturated Hydrocarbon:** The hydrocarbons in which two carbon atoms are linked by double or a triple bond are called unsaturated hydrocarbons.

These are called alkenes and alkynes.

General formula of alkene:  $C_nH_{2n}$

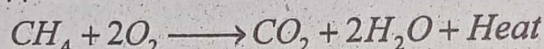
General formula of alkyne:  $C_nH_{2n-2}$

17. What is meant by combustion?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: **Combustion Process:**

Alkanes burn in the presence of excess of air or oxygen to produce a lot of heat, carbon dioxide and water. This reaction takes place in automobile combustion engines, domestic heaters and cooking appliances.

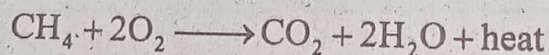


18. How Hydrocarbons are used as fuel?

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans: **Hydrocarbons Act as Fuel:**

Hydrocarbon burn in the excess of air or oxygen to produce a lot of heat, carbon dioxide and water. So hydrocarbons are used as fuels. It is highly exothermic reaction and because of it alkanes are used as fuel.

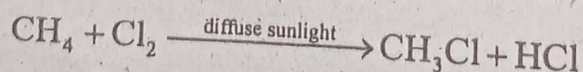


19. What do you know about halogenation of Alkanes?

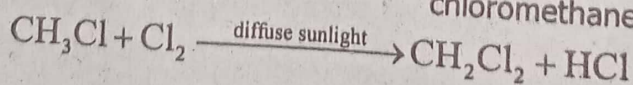
(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: **Halogenation reaction:** "A reaction in which one or more hydrogen atoms of a saturated compound are replaced with some other atoms (like halogen) is called a substitution reaction." or halogenation.

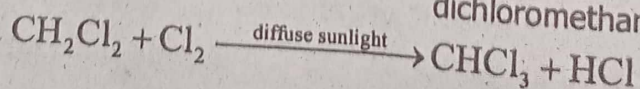
Equation:



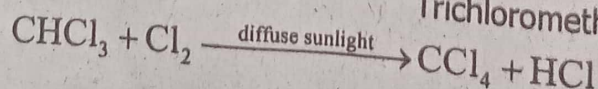
chloromethane



dichloromethane



Trichloromethane



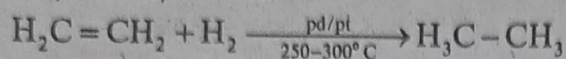
Tetrachloromethane



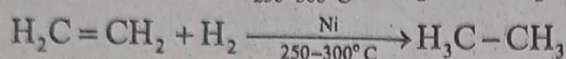
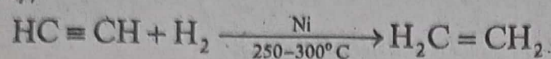
20. Define the process of hydrogenation. Give example.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans:** Hydrogenation means addition of molecular hydrogen in alkenes and alkynes. Alkenes and alkynes are unsaturated compounds, so they have the capacity to add up atoms in them. This reaction is carried out in the presence of nickel catalyst at 250°C to 300°C. However, in the presence of catalyst platinum or palladium, the reaction takes place at room temperature, such as:



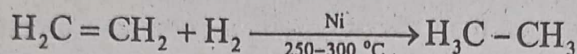
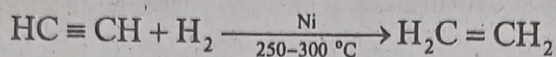
Similarly,



21. Complete and balance the given reaction:  $\text{HC}\equiv\text{CH} + \text{H}_2 \xrightarrow{?} ?$

(SGD-I/II, DGK-II, SWL-II)

**Ans.**



22. Write down two uses of methane.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans. Uses of Methane:** (i) Natural gas that is chiefly methane, is used as domestic fuel.  
(ii) Compressed natural gas (CNG) is used as automobile fuel.

## 12.2

## Alkenes

23. State one important use of each:

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

(a) Chloroform

(b) Carbon tetra chloride.

**Ans:** a) **Use of chloroform:** Chloroform is used as a solvent for rubber, waxes etc and for anaesthesia.

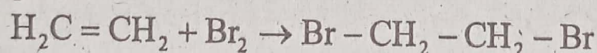
b) **Use of carbon tetrachloride:**

Carbon tetrachloride is used as an industrial solvent and dry cleaner.

24. Why colour of bromine water discharges on addition of ethene in it?

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** Colour of bromine water discharges on addition of ethene because double bond of ethene is converted into a single bond.



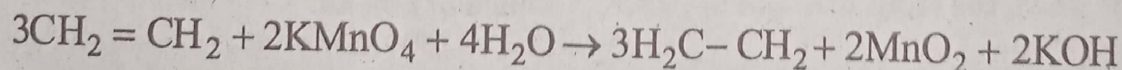
This reaction is used to identify the unsaturation of an organic compound.

25. How can you identify ethane from ethene?

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans:** Ethene decolorize the pink colour of acidified dilute solution of potassium permanganate because the double bond electrons react with  $\text{MnO}_4^-$  ion, which further goes on reaction to form  $\text{MnO}_4^-$  and colorless ethane glycol (1,2 - ethanediol). Such as, there is addition of two 'hydroxyl group' at the double bond.

**Equation:**



Ethene

$\begin{array}{c} \text{OH} \quad \text{OH} \\ | \quad | \end{array}$

1,2 - Ethanediol

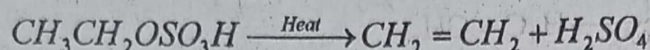
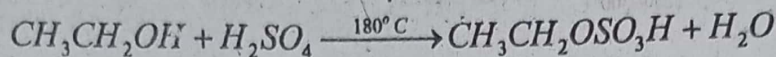


While ethane does not decolorize the pink colour of  $\text{KMnO}_4$  as it is saturated one. In this way, we can identify ethene from ethane.

26. What happens when ethyl alcohol is heated in the presence of  $\text{H}_2\text{SO}_4$ ?

(SGD-I/II, DGK-II, SWL-II)

**Ans: Dehydration of Alcohols:** Dehydration is removal of water. Ethene is prepared by heating a mixture of ethanol and excess of concentrated  $\text{H}_2\text{SO}_4$  at  $180^\circ\text{C}$ . In first step ethyl hydrogen sulphate is formed which decompose on heating to produce ethane.



27. Describe two physical properties of alkenes.

(DGK-GI, DGK-GII, SWL-GII)

**Ans: Physical properties of alkenes:**

- (i) The first member of the alkenes is ethene. It is a colourless gas with pleasant odour.
- (ii) Alkenes are non-polar, therefore, they are insoluble in water but soluble in organic solvents.

28. Describe two occurrence of Alkenes.

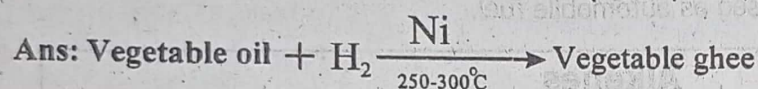
(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans: Occurrence of Alkenes:**

- (i) Alkenes being more reactive than alkanes, seldom occur free in nature.
- (ii) Lower alkenes occur in coal gas in minute quantities.

29. Write an equation to change oil into ghee.

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)



## 12.3

## Alkynes

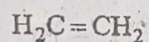
30. What is the difference between alkenes and alkynes?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

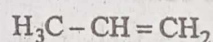
**Ans: Alkenes:** (i) The compounds in which two carbon atoms are linked by a double covalent bond are called alkenes.

(ii) **General formula:** They have general formula  $\text{C}_n\text{H}_{2n}$  and functional group  $> \text{C} = \text{C} <$ .

(iii) **Examples:** For example, ethene and propene.



Ethene



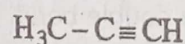
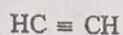
Propene

**Alkynes:** The hydrocarbons in which the two carbon atoms are linked by a triple covalent bond are called alkynes.

(ii) **General formula:**

They have general formula  $\text{C}_n\text{H}_{2n-2}$  and functional group  $-\text{C} \equiv \text{C}-$ .

(iii) **Examples:** For example, ethyne and propyne.



31. Write down the Molecular and Structural formula of Ethyne.

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans:** Molecular formula of Ethyne  $\text{C}_2\text{H}_2$

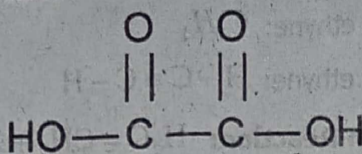
Structural formula of Ethyne:  $\text{H} - \text{C} \equiv \text{C} - \text{H}$



## 32. What is the formula of Oxalic Acid?

BWP-GII,SGD-GI

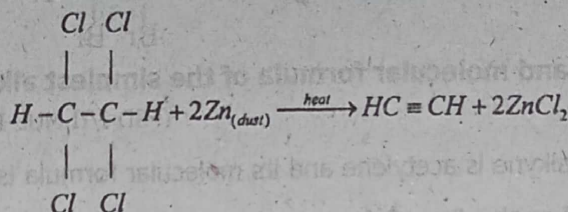
Ans: Formula of Oxalic acid is



## 33. Prepare acetylene from tetrachloroethane. (FSD-I/II,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

Ans: Preparation of acetylene by tetra-chloroethane:

When alkyl tetra-chloroethane is heated with Zinc dust, the elimination of halogen atoms takes place to form acetylene.



## 34. Write down two uses of Acetylene.

(MTN-GII,DGK-GI,GUJ-GII)

Ans: Uses of Acetylene: (i) Acetylene produces oxyacetylene flame with oxygen. It is highly exothermic reaction. Heat released is used for welding purposes:

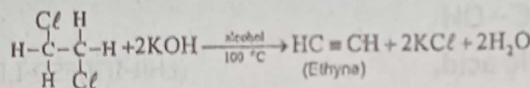
(ii) It is used for ripening of fruits.

## 35. Give the preparation of Alkynes by Dehydrohalogenation of vicinal dihalides.

(LHR-I/II,FSD-I,DGK-I,SWL-I,MUL-II)

Ans: Dehydrohalogenation of vicinal dihalides:

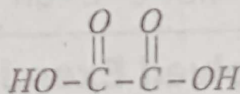
When a vicinal dihalide is heated with alcoholic KOH, two hydrogen atoms along with two halogen atoms are removed two adjacent carbon atoms with the formation of a triple bond between the adjacent carbons.



## 36. Write down the formulae of oxalic acid and carbon tetrachloride.

(GUJ-I/II,,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

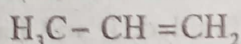
Ans. Formula of oxalic acid:

Formula of carbon tetrachloride:  $\text{CCl}_4$ 

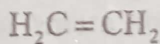
## 37. Which functional groups are present in alkenes and alkynes?

(SGD-I/II,DGK-II,SWL-II)

Ans. (a) alkenes: The compounds in which two carbon atoms are linked by a double bond are called alkenes. For example, ethene and propene.



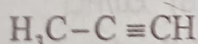
(Propene)



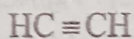
(Ethene)

These compounds have general formula  $\text{C}_n\text{H}_{2n}$  and functional group  $\text{>C=C<}$

(b) Alkynes: The hydrocarbons in which two carbon atoms are linked by a triple bond are called alkynes. For example, ethyne and propyne.



(Propyne)



(Ethyne)

They have general formula  $\text{C}_n\text{H}_{2n-2}$  and functional group  $-\text{C} \equiv \text{C}-$



38. Write the molecular and structural formula for Ethyne.

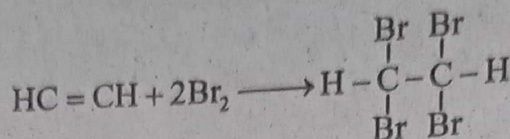
Ans: Molecular formula for ethyne:  $C_2H_2$

Structural formula for ethyne:  $H-C \equiv C-H$

39. Complete the given Reaction:  $H_2C=CH_2 + 2Br_2 \longrightarrow ?$

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans.



40. Write the name and molecular formula of the simplest alkyne.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Name of simplest alkyne is acetylene and its molecular formula is  $C_2H_2$ .

41. Write one use of each of acetylene and chloroform.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Use of chloroform: It is used as a solvent for rubber, waxes, etc., and for anaesthesia.

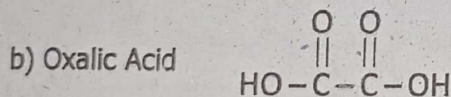
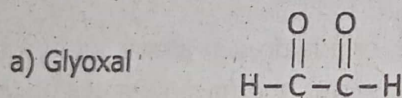
Use of Acetylene: It is used for welding.

42. Write the structural formulae of the following. (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

(a) Glyoxal

(b) Oxalic acid

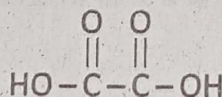
Ans: Structural formula of



43. Write the formula of oxalic acid.

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: Formula of Oxalic Acid:



## Solved Exercise

### Multiple Choice Questions

- Which one of these hydrocarbon molecules would have no effect on an aqueous solution of bromine? (MLT-I)(ALP)  
 (a)  $CH_4$  (b)  $C_{10}H_{20}$  (c)  $C_2H_4$  (d)  $C_2H_2$
- If an organic compound has 4 carbon atoms, all singly bonded, it will have the following characteristics except one.  
 (a) It will be saturated hydrocarbon (b) Its name will be n-butane.  
 (c) It will have 8 hydrogen atoms (d) It will be least reactive
- The reduction of alkyl halides takes place in the presence of. (DGK-II, MLT-I, LHR-I)(ALP)  
 (a)  $Zn/HCl$  (b)  $Na/HCl$  (c)  $Mg/HCl$  (d)  $Cu/HCl$
- Halogenation of methane does not produce which one of the following: (SWL-I)(ALP)  
 (a) Carbon tetrachloride (b) Chloroform  
 (c) Carbon black (d) Chloromethane



5. Incomplete combustion of alkanes produces:
  - (a) Carbon dioxide only
  - (b) Carbon monoxide only
  - (c) Carbon monoxide and carbon black
  - (d) Carbon dioxide and carbon black
6. Alkenes are prepared from a alcohols by a process called. (MLT-II, FSD-I, LHR-I)(ALP)
  - (a) Dehydrogenation
  - (b) Dehalogenation
  - (c) Dehydration
  - (d) Dehydrohalogenation
7. Dehydrohalogenation takes place in the presence of: (DGK-I, MLT-II)(ALP)
  - (a) NaOH. aqueous
  - (b) Alcoholic KOH
  - (c) Aqueous KOH
  - (d) Alcoholic NaOH
8. Oxidation of ethane with  $\text{KMnO}_4$  produces. (DGK-II, BWP-I)(ALP)
  - (a) Oxalic acid
  - (b) Glyoxal
  - (c) Ethane glycol
  - (d) Propene glycol
9. Which one of these is a saturated hydrocarbon?
  - (a)  $\text{C}_2\text{H}_4$
  - (b)  $\text{C}_3\text{H}_6$
  - (c)  $\text{C}_4\text{H}_8$
  - (d)  $\text{C}_5\text{H}_{12}$
10. A hydrocarbon has molecular formula  $\text{C}_8\text{H}_{14}$ . What is the molecular formula of the next member of the same homologous series?
  - (a)  $\text{C}_9\text{H}_{18}$
  - (b)  $\text{C}_9\text{H}_{16}$
  - (c)  $\text{C}_9\text{H}_{20}$
  - (d)  $\text{C}_9\text{H}_{12}$
11. The molecular formulae of the first three members of the alkanes hydrocarbons are  $\text{CH}_4$ , and  $\text{C}_3\text{H}_8$ . What is the molecular formula for eight alkane member, octane, which is found in petrol?
  - (a)  $\text{C}_8\text{H}_8$
  - (b)  $\text{C}_8\text{H}_{16}$
  - (c)  $\text{C}_8\text{H}_{18}$
  - (d)  $\text{C}_8\text{H}_{20}$
12. One of the hydrocarbons reacts with one mole of hydrogen to form a saturated hydrocarbon. What formula could be of the X? (SRG-II)(ALP)
  - (a)  $\text{C}_3\text{H}_8$
  - (b)  $\text{C}_6\text{H}_{12}$
  - (c)  $\text{C}_4\text{H}_{10}$
  - (d)  $\text{C}_7\text{H}_{16}$
13. Dehydration of alcohols can be carried out with. (SRG-II, GUJ-I)(ALP)
  - (a) NaOH
  - (b) KOH
  - (c)  $\text{H}_2\text{SO}_4$
  - (d) HCl
14. The end product of oxidation of acetylene is: (BWP-II, RWP-I, SWL-I, DGK-I, FSD-I)(ALP)
  - (a) Oxalic acid
  - (b) Glycol
  - (c) Glyoxal
  - (d) None of these
15. Dehalogenation of tetrahalides produces acetylene. This reaction takes place in the presence of.
  - (a) Sodium metal
  - (b) Zinc metal
  - (c) Magnesium metal
  - (d) Potassium metal
16. Substitution reaction is the characteristic of: (BWP-I/II, RWP-I/II)(ALP)
  - (a) Alkanes
  - (b) Alkenes
  - (c) Alkynes
  - (d) None of these
17. Halogenation of methane in the presence of diffused sunlight takes place.
  - (a) Suddenly, only in one step
  - (b) Slowly in one step
  - (c) In a series of four steps
  - (d) Fastly in two steps
18. Which one of the followings is a substitution reaction?
  - (a) Halogenations of alkynes
  - (b) Halogenations of alkenes
  - (c) Halogenations of alkanes
  - (d) Bromination of alkanes
19. The order of reactivity of hydrogen halides with alkenes is:
  - (a)  $\text{HI} > \text{HBr}$
  - (b)  $\text{HBr} > \text{HI}$
  - (c)  $\text{HCl} > \text{HBr}$
  - (d)  $\text{HBr} < \text{HCl}$



20. Oxidation of alkenes produces:

(a) Glyoxal

(b) Glycol

(c) Oxalic acid

(d) Formic acid

### Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | a | 2  | b | 3  | a | 4  | c | 5  | c |
| 6  | c | 7  | b | 8  | c | 9  | d | 10 | B |
| 11 | c | 12 | b | 13 | c | 14 | a | 15 | b |
| 16 | a | 17 | c | 18 | c | 19 | a | 20 | b |

### Short Questions

1. Differentiate between saturated and unsaturated hydrocarbons.

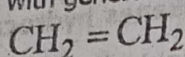
**Ans. Saturated hydrocarbons:** The hydrocarbons in which all the four valencies of carbon atoms are fully satisfied (saturated) by single bonds with other carbon atoms and hydrogen atoms is called saturated hydrocarbons.

Saturated hydrocarbons are also called alkane with general formula  $C_nH_{2n+2}$

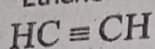
Example: Methane ( $CH_4$ ), ethane ( $C_2H_6$ ).

**Unsaturated hydrocarbons:** The hydrocarbons in which two carbon atoms are linked by a double or a triple bond are called unsaturated hydrocarbons.

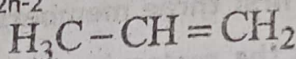
Unsaturated hydrocarbons are also called alkene with general formula  $C_nH_{2n}$  and alkynes with general formula  $C_nH_{2n-2}$



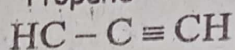
Ethene



Ethyne



Propene

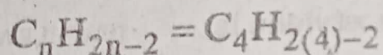


Propyne

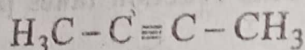
2. A compound consisting of four carbon atoms has a triple bond in it. How many hydrogen atoms are present in it?

**Ans.** As four carbon atoms and triple bond indicates that it is an alkyne and number of carbon atoms is four. The general formula of alkyne is.

So we get



$C_4H_6$  is butyne that has six number of hydrogen atoms in it with formula



3. Why the alkanes are called 'paraffins'?

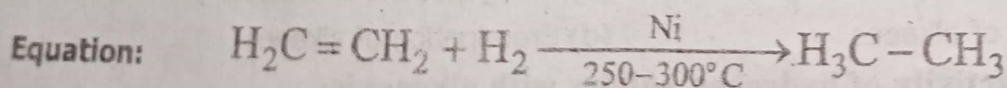
**Ans.** The simplest hydrocarbons are alkanes. In these compounds, all the bonds of carbon atoms are single it means carbon atoms are saturated. Therefore, they are least reactive. That is the reason, alkanes are called paraffins, para means less and affins means affinity or reactivity.

4. What do you know about hydrogenation of alkenes?

(DGK-I, SRG-II)(ALP)

**Ans. Hydrogenation of alkenes:**

Hydrogenation means addition of molecular hydrogen to an unsaturated hydrocarbon in the presence of a catalyst (Ni, Pt) to form saturated compound.



On industrial scale, this reaction is used to convert vegetable oil into margarine (banaspat ghee).



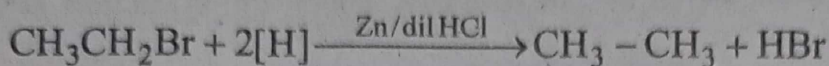
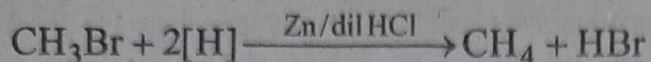
**Equation:** Oil + H<sub>2</sub>  $\xrightarrow{\text{Ni}}$  Margarine (Banaspatti ghee).

**5. How alkyl halides are reduced?**

(BWP-II, SWL-I, MLT-II, RWP-I, LHR-I)(ALP)

**Ans. Reduction of alkyl halides:**

Reduction means addition of nascent hydrogen. In fact, it is a replacement of a halogen atom with a hydrogen atom. This reaction takes place in the presence of Zn metal and HCl



**6. Why the alkanes are used as fuel?**

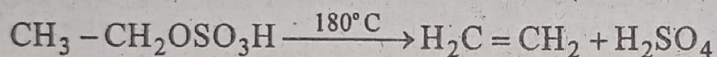
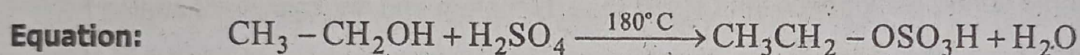
**Ans.** Alkanes burn in the presence of excess of air or oxygen to produce a lot of heat carbon dioxide and water. This reaction takes place in automobile combustion engines, domestic heaters and cooking appliances. It is highly exothermic reaction and because of it, alkanes are used as fuel.

**Equation:**  $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{heat}$

**7. How can you prepare ethene from alcohol and ethyl bromide?**

**Ans. i) Dehydration of alcohol:**

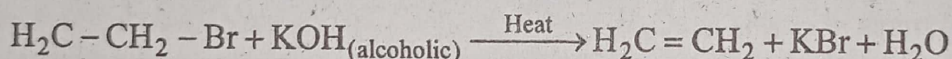
Ethene is prepared by heating a mixture of ethanol and excess of concentrated sulphuric acid at 180°C. In first step, ethyl hydrogen sulphate is formed which decomposes on heating to produce ethene, which is collected over water.



**ii) Dehydrohalogenation of alkyl halides:**

On heating ethyl bromide with alcoholic KOH, ethane is formed. Removal of hydrogen and halogen takes place from adjacent carbon atoms to create a double bond.

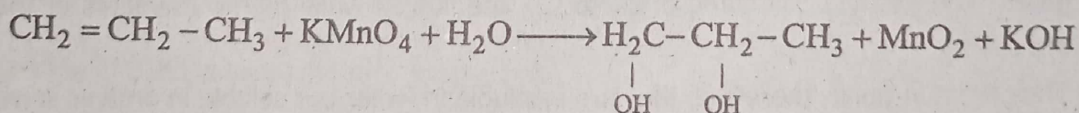
**Equation:**



**8. Identify propane from propene with a chemical test.**

**Ans.** Propene decolourises the pink colour of acidified dilute solution of potassium permanganate because of reactivity of double bond electrons with MnO<sub>4</sub> ion, which further goes on reaction to eliminate MnO<sub>2</sub> with the formation of colorless propane glycol such as, there is addition of 'hydroxyl group' at the double bond.

**Equation:**



**9. Why the alkenes are called 'olefins'?**

(DGK-I)(ALP)

**Ans.** Alkenes are also known as olefins (a Latin word meaning oil forming) because first members of alkene series form oily products when react with halogens.

**10. Why alkane can't be oxidized with KMnO<sub>4</sub> solution?**

(DGK-I)(ALP)

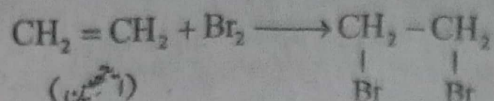
**Ans.** Alkane does not decolourise the pink colour of acidified dilute solution of potassium permanganate solution and can't be oxidized because there is no double or triple bond present in alkane. Therefore alkane cannot be oxidized with KMnO<sub>4</sub> solution.



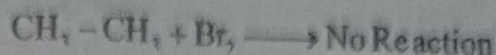
- 11. What are the addition reactions? Explain with an example.** (MLT-1, BWP-1, G.D.)
- Ans.** These are the reactions in which the products are formed by the addition of some reagent like  $H_2, Cl_2$ , etc. to an unsaturated organic compound. In this process, one of the double bond gets broken and two new single bonds are formed.
- Example:**  $CH_2 = CH_2 + H_2 \xrightarrow{Ni} CH_3 - CH_3$
- Hydrogenation of alkenes:** Hydrogenation means addition of hydrogen molecule ( $H_2$ ) to an unsaturated hydrocarbon in the presence of a catalyst (Ni, Pt) to form a saturated compound.
- 12. Justify that alkanes give substitution reactions.**
- Ans.** Alkanes give only substitution reaction as in alkanes all bonds are single bonds which are very strong. In substitution reaction, one or more hydrogen atoms of a saturated compound are replaced with some other atoms (like halogen). These reactions are characteristic property of alkanes because only these are saturated compounds having single bonds.
- 13. Both, alkenes and alkynes are unsaturated hydrocarbons. State the one significant difference between them.**
- Ans.** Both, alkenes and alkynes are unsaturated hydrocarbons. The most significant difference between them is that alkenes are unsaturated having double bond present between carbon atoms and are capable of adding one molecule of reagent while alkynes are unsaturated having triple bond present between carbon to carbon atom and are capable of adding two molecules of reagent. Alkenes are shown as  $>C=C<$  and alkynes as  $-C\equiv C-$ . The general formula of alkene is  $C_nH_{2n}$  and that of alkyne is  $C_nH_{2n-2}$ .
- 14. Write the molecular, dot and cross and structural formula of ethyne.**
- Ans.** The dot and cross formula of ethyne is:  $H \times \cdot C \equiv C \cdot \times H$
- Structural formula of ethyne is:  $H - C \equiv C - H$
- Molecular formula of ethyne is:  $C_2H_2$
- 15. Why hydrocarbons are soluble in organic solvents?**
- Ans.** Because all the hydrocarbons are non-polar in nature. According to the rule "like dissolves like". The non-polar hydrocarbons are soluble in non-polar organic solvents.
- 16. Give the physical properties of alkanes.**
- Ans.** (i) Alkanes form a homologous series of compounds. First four members of the series are gases. The alkanes consisting of  $C_5$  to  $C_{10}$  are liquids while higher members of the series are solids.
- (ii) They are non-polar, therefore, they are insoluble in water but soluble in organic solvents.
- (iii) The density of alkanes increases gradually with the increase of molecular size.
- (iv) The melting and boiling points of alkanes increase regularly with the increase of molecular sizes. This is because of increase of attractive forces between the molecules of alkanes.
- 17. How can you identify ethene from ethane?**
- Ans.** When ethene reacts with Bromine water. The red brown colour of Bromine water disappears. But when ethane reacts with bromine water. There is no change in colour, no reaction takes place.



**Equation:**



Ethene



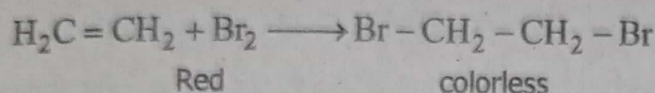
Ethene

While ethane does not decolorize the pink colour of  $\text{KMnO}_4$  as it is saturated one. In this way, we can identify ethene from ethane.

8. Why colour of bromine water discharges on addition of ethane in it?

**ins.** Halogenation means addition of halogen like  $\text{Cl}_2$   $\text{Br}_2$ . When bromine water (solution of bromine in water having red colour) is added to ethene in an inert solvent like carbon tetrachloride, its colour is discharge at once.

quation:



In this reaction double bond of ethene is converted into a single bond by addition of a molecule of bromine. This reaction can occur if there is un-saturation of compound. As alkane; ethane has single bond among carbon-carbon atom, can't undergo addition reaction on reaction with bromine. In this way, ethane can be identified from ethene by using solution of bromine water.

**State one important use of each:**

### I. Ethene

## ii. Acetylene

### iii. Chloroform

iv. Carbon tetrachloride

s. **1. Ethene:** For artificial ripening of fruits.

**Acetylene:** Acetylene produces oxy-acetylene flame with oxygen. It is a highly exothermic reaction. Heat released is used for welding purposes.

**Chloroform:** Chloroform is used as a solvent for rubber, waxes, etc. and for anesthesia.

### Carbon tetrachloride:

Carbon tetrachloride is used an industrial solvent and in dry cleaning.

## Extensive Questions

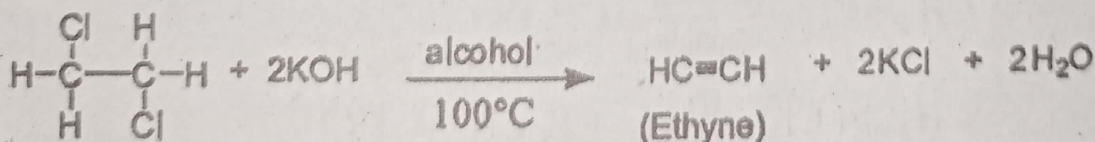
**Write a note on preparation of alkynes.**

[RWP-GI-21](ALP)

### Preparation of Alkynes:

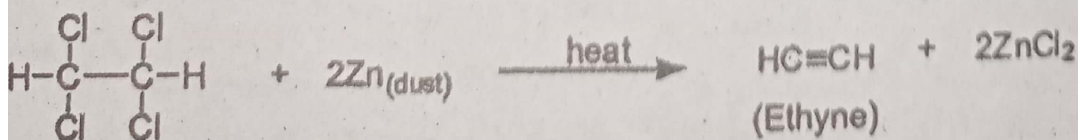
**Dehydrohalogenation of vicinal dihalides:** When a vicinal dihalide is heated with alcoholic KOH, two hydrogen atoms along with two halogen atoms are removed from two adjacent atoms with the formation of a triple bond between the adjacent carbons:

ation:



**Dehalogenation of tetrahalides:** When alkyl tetrahalides are heated with Zinc dust, the elimination of halides takes place to form ethyne.

tion:



**Write the uses of acetylene.**

[SWL-21][DGK-GI-21][MTN-GI-21](ALP)

**Uses of Acetylene:** (i) It is used for the ripening of fruits.

**Uses of Acetylene:** (i) It is used for the ripening of fruits.  
Acetylene produces oxy-acetylene flame with oxygen. It is a highly exothermic reaction.  
Heat released is used for welding purposes.



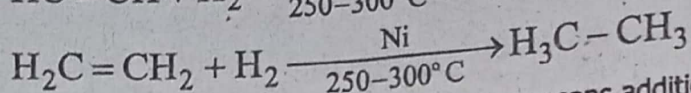
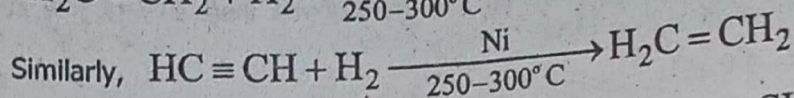
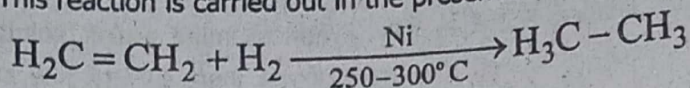
- (iii) It is polymerized to form benzene, which is used as raw material to form a variety of organic compounds.
- (iv) Acetylene is used to prepare other chemicals, such as, alcohol, acetaldehyde and acids.
- (v) It is used for the manufacturing of polymer products like polyvinyl chloride, polyacetate and synthetic rubber like neoprene.

[RWP-GII-21][DGK-GII-21](A)

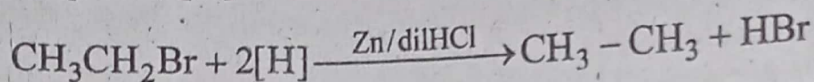
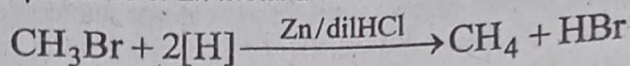
3. Write two methods to prepare Alkanes and explain.

Ans: (1) **Hydrogenation of alkenes and alkynes:**

**Hydrogenation:** "Hydrogenation means addition of hydrogen in alkenes and alkynes." This reaction is carried out in the presence of nickel catalyst at 250°C to 300°C.



- (2) **Reduction of alkyl halides:** Reduction: "Reduction means addition of nascent hydrogen. It is a replacement of a halogen atom with a hydrogen atom. This reaction takes place in the presence of Zn metal and HCl."

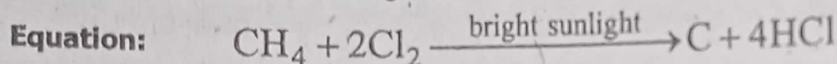


4. What type of reactions are given by alkanes? Explain with reference to halogenation of alkanes.

[GUJ-GI-21][SGD-GII-21](A)

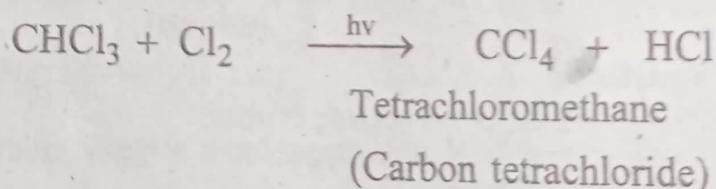
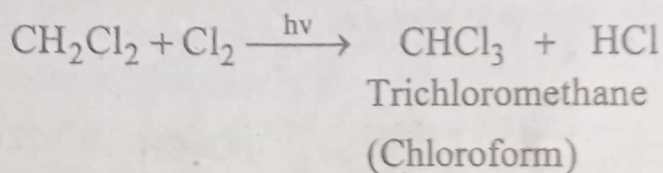
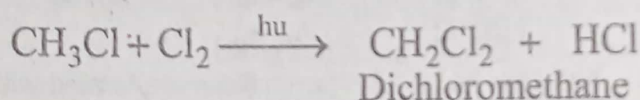
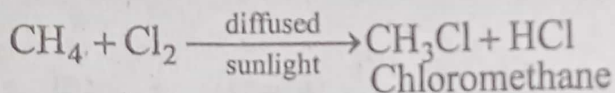
Ans: **Substitution reaction:**

"A reaction in which one or more hydrogen atoms of a saturated compound are replaced by some other atoms (like halogen) is called a substitution reaction." Alkanes give only substitution reactions. These reactions are a characteristic property of alkanes. Alkanes react fairly with halogens in diffused sunlight only. In dark there is no reaction. In direct sunlight reaction is explosive and carbon is deposited.



In diffused sunlight, a series of reactions take place and at each step one hydrogen atom is substituted by halogen atoms, so that all the hydrogen atoms are substituted by halogen atoms, so that all the hydrogen atoms are substituted one by one by halogen atoms.

**Equations:**





Chapter

13

Biochemistry

All Punjab Past Board Papers  
2014 - 2021

## ALP Annual Paper 2021

## MCQ's

- Which is reducing sugar? (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Glucose (B) Maltose (C) Sucrose (D) Starch
- General formula of carbohydrates is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A)  $C_nH_n$  (B)  $C_n(H_2O)_n$  (C)  $C_n(OH)_n$  (D) none of these

2014 - 2020

13.1

## Carbohydrates

- Lactose consists of glucose and: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A) sucrose (B) maltose (C) starch (D) galactose
- The most important oligo saccharide is: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
(A) sucrose (B) glucose (C) fructose (D) maltose
- Which one of the following is crystalline solid? (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Glucose (B) Starch (C) Cellulose (D) Glycogen
- Glucose is a: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) Hexahydroxy aldehyde (B) Pentahydroxy aldehyde  
(C) Pentahydroxy ketone (D) Hexahydroxy ketone
- Pentahydroxy aldehyde is called: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) glucose (B) fructose (C) starch (D) sucrose
- Chemical Formula of Fructose is: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $C_{12}H_{22}O_{11}$  (B)  $C_6H_{12}O_6$  (C)  $C_4H_{10}$  (D)  $C_5H_{12}$
- Maltose is generally found in:- (SGD-I/II, DGK-II, SWL-II)  
(A) Milk (B) Cereals (C) Dairy products (D) Cotton
- Fatty acids are the building blocks of: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A) lipids (B) protein (C) glucose (D) vitamin

13.2

## Proteins

- Which one of the following is triglyceride: (LHR-GI, II, FSD-GII, DGK-GII, BWP-GI, II, SWL-GII, I)  
(A) Carbohydrates (B) Proteins (C) Lipids (D) Vitamins
- Formula of stearic acid is: (SGD-GI, RWP-GI, LHR-GII)  
(A)  $C_{17}H_{35}COOH$  (B)  $C_{17}H_{33}COOH$  (C)  $C_{17}H_{37}COOH$  (D)  $C_{15}H_{31}COOH$
- Proteins make up \_\_\_\_\_ percentage of the dry weight of animal cell: (FSD-GI, DGK-GI)  
(A) 25 (B) 50 (C) 75 (D) 100



14. Rancid butter has a foul smell because of:  
 (A) Butanoic acid (B) Nitric acid (C) Tartaric acid (D) Sulphuric acid  
 (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I, MTN-I, RWP-I, BWP-II, SC)
15. Formula of Palmitic acid is:  
 (A)  $C_5H_{11}COOH$  (B)  $C_{15}H_{31}COOH$  (C)  $C_{17}H_{35}COOH$  (D)  $C_{13}H_{27}COOH$   
 (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-I, MTN-I, RWP-I, BWP-II, SC)
16. The organic compounds used as drugs to control bleeding are:  
 (A) Vitamins (B) Proteins (C) Lipids (D) Glycerides  
 (SGD-I/II, DGK-II, SWL-I, MTN-I, RWP-I, BWP-II, SC)
17. Amino Acids are link to each other through:  
 (A) Hydrogen Link (B) Ionic Link (C) Gelatin Link (D) Peptide Link  
 (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I, MTN-I, RWP-I, BWP-II, SC)
18. The organic compounds used as drugs to control bleeding are:  
 (A) Vitamins (B) Proteins (C) lipids (D) glycerides  
 (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-I, MTN-I, RWP-I, BWP-II, SC)
19. Enzymes are proteins, which one the following properties they do not have?  
 (A) They catalyze reaction (B) They are not specific  
 (C) They are highly efficient (D) They are produced by living cells  
 (LHR-I/II, FSD-I, DGK-I, SWL-I, MTN-I, RWP-I, BWP-II, SC)
20. Number of amino acids in proteins is:  
 (A) 1000 (B) less than 10,000 (C) more than 10000 (D) 2000  
 (GUJ-I, FSD-I, DGK-I, SWL-I, MTN-I, RWP-I, BWP-II, SC)
21. Amino acids which cannot be synthesized by our body:  
 (A) Non Essential (B) Proteins (C) Essential (D) Amino acids  
 (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-I, MTN-I, RWP-I, BWP-II, SC)

13.3

## Lipids

13.4

## Nucleic Acids

13.5

## Vitamins

22. DNA consist of:  
 (A) Ribose (B) Pentose (C) Deoxyribose sugar (D) Phosphate  
 [LHR-II, GUJ-II, MTN-II, SWL-II, RWP-II, BWP-II, SC]
23. Watson and crick discover the structure of DNA in:  
 (A) 1950 (B) 1952 (C) 1953 (D) 1955  
 [MTN-I, GUJ-I, FSD-II, SWL-I, RWP-I, BWP-II, SC]
24. Which vitamin is fat soluble:  
 (A) A (B) E (C) K (D) All of these  
 [FSD-I, DGK-II, BWP-II, SC]
25. Eye inflammation is caused by the deficiency of vitamin:  
 (A) Vitamin D (B) Vitamin C (C) Vitamin B (D) Vitamin A  
 [FSD-I, DGK-II, BWP-II, SC]
- The Night blindness is because of deficiency of:  
 (A) Vitamin A (B) Vitamin E (C) Vitamin (D) Vitamin E  
 [LHR-I, GUJ-II, RWP-I, MTN-I, SWL-I, BWP-II, SC]
- Which vitamin is soluble in water?  
 (a) Vitamin A (B) Vitamin C (C) Vitamin D (D) Vitamin D  
 [GUJ-I, FSD-II, DGK-II, RWP-I, MTN-I, BWP-II, SC]
- Which one of the following is a fat soluble vitamin?  
 (A) Vitamin A (B) Vitamin B (C) Vitamin C (D) All of these  
 [RWP-I, GUJ-I, MTN-I, SWL-I, BWP-II, SC]



29. Deficiency of Vitamin E causes:

[MTN-II, DGK-I, SWL-II]

(A) Scurvy

(B) Rickets

(C) Night Blindness

(D) Anemia

## Answers

|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | A | 2  | B | 3  | D | 4  | A | 5  | A | 6  | B | 7  | A | 8  | B | 9  | B | 10 | A |
| 11 | C | 12 | A | 13 | B | 14 | A | 15 | D | 16 | B | 17 | D | 18 | B | 19 | B | 20 | C |
| 21 | C | 22 | C | 23 | C | 24 | D | 25 | D | 26 | A | 27 | B | 28 | A | 29 | D |    |   |

## ALP Annual Paper 2021

## Short Questions

1. Define carbohydrates, write their general formula.

(LHR-GI, DGK-GI, II, SGD-GI)

Ans: **Carbohydrates:** Carbohydrates are macromolecules defined as polyhydroxy aldehyde or Ketones.

General formula. They have general formula  $C_n(H_2O)_n$

2. Give the characteristics of polysaccharides. (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: (i) They are amorphous solids. (ii) They are tasteless and insoluble in water.  
(iii) They are non reducing in nature.

3. What are Monosaccharides?

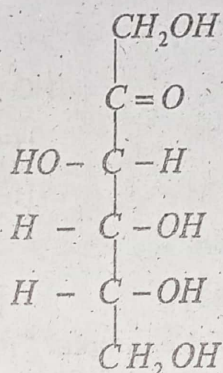
(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: **Monosaccharides:** Monosaccharides are the simplest sugars which cannot be hydrolyzed. They consist of 3 to 9 carbon atoms. Therefore, they are classified according to the number of carbon atoms in their molecules as trioses, tetroses, pentoses, hexoses, and so on. The important monosaccharides are hexoses like glucose and fructose.

4. Write structural formula of fructose.

(SGD-I/II, DGK-II, SWL-II)

Ans: Structure formula of Fructose:



5. What is the difference between Essential and Non-essential Amino Acids.

(MTN-GII, LHR-I, SWL-GI, MTN-GI, GUJ-GI, II, SGD-GI)

Ans:

| Essential Amino Acids   | Non-essential Amino Acids  |
|---|--|
| (i) Ten out of twenty amino acids which cannot be synthesized by human body are called essential amino acids. | (i) The amino acids which can be synthesized by human body are called essential amino acids. They are also ten in numbers. |
| (ii) These amino acids are required by human body and must be supplied through diet.                          | (ii) These amino acids are not required by human body and so there is no need to take them through diet.                   |

6. Define proteins and name its basic unit.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: **Proteins:** Proteins are highly complicated nitrogenous compounds made up of amino acids. Amino acids are basic units of proteins.



**Basic unit:** Amino acid is the basic unit of protein. Amino acids are organic compounds consisting of both amino and carboxyl group.

7. Write the chemical formulas of palmitic acid and stearic acid. (MTN-GI, LHR-GI, SWL-GI)

Ans: Palmitic acid  $C_{15}H_{31}COOH$

Stearic acid  $C_{17}H_{35}COOH$

8. What is difference between ghee and oil? (FSD-GII, DGK-GII, SWL-GII, MTN-GI, II, GUJ-GII)

Ans:

| Oil   | Ghee  |
|---|---|
| (i) Oils exist in liquid form at room temperature.      | (i) While Ghee exist in solid form at room temperature. |
| (ii) They are triglycerides of unsaturated fatty acids. | (ii) They are triglycerides of saturated fatty acids.   |

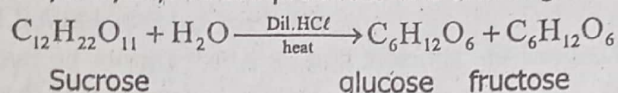
2014 - 2020

### 13.1

### Carbohydrates

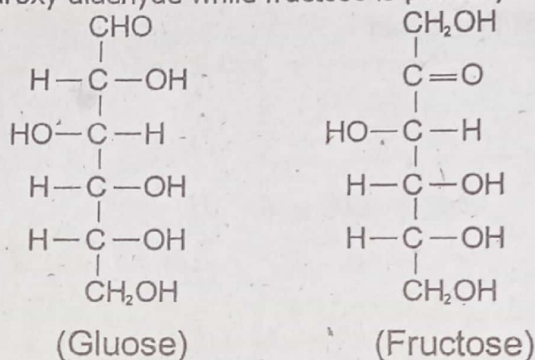
9. Give the balanced equation for the hydrolysis of sucrose. (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans: On hydrolysis, sucrose produces one unit of glucose and one unit of fructose.



10. What is the difference between glucose and fructose? (SWL-GI, II, RWP-GII, GUJ-GI, LHR-GI, GII, SGD-GII)

Ans: Glucose is a pentahydroxy aldehyde while fructose is pentahydroxy ketone.

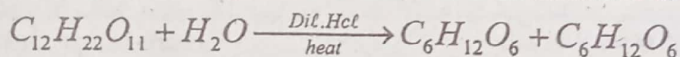


11. What are oligosaccharides? Give example. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Oligosaccharides give 2 to 9 units of monosaccharides on hydrolysis.

These carbohydrates are white, crystalline solids easily soluble in water. They are also sweet in taste. They may be reducing or non-reducing.

**Example:** The most important oligosaccharides are disaccharides like sucrose.



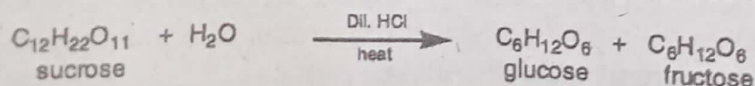
12. Describe sources of sucrose and starch. (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Sucrose is found in sugar beet, sugar cane and fruits, while starch is found in cereal crops, wheat, barley, maize, rice etc.

13. How Disaccharides are Hydrolyzed to Monosaccharides? (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: The most important oligosaccharides are disaccharides like sucrose.

On hydrolysis, sucrose produces one unit of glucose and one unit of fructose.





14. Define polysaccharides and give one example.

(GUJ-GI, RWP-GII, DGK-I, II, BWP-GI, LHR-GI, SWL-GII)

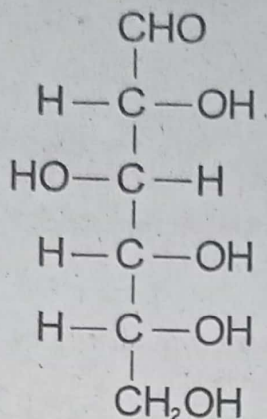
**Ans: Polysaccharides:** Polysaccharides are macromolecular carbohydrates consisting of hundreds to thousands of monosaccharides.

Examples of polysaccharides are starch and cellulose.

15. Write structural formula of glucose.

(GUJ-GI, SWL-GI, LHR-GII, DGK-GI)

**Ans: Structural formula of glucose:**



16. What are carbohydrates? Write names of three classes.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans: Carbohydrates:**

Carbohydrates are macromolecules defined as poly hydroxyl aldehydes or ketones.

They have general formula.  $\text{C}_n(\text{H}_2\text{O})_n$

**Example:** Glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ )

Sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ )

**Names of Classes:** Monosaccharides, oligosaccharides and polysaccharides.

17. Give the characteristics of disaccharides (any two).

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans:** i. Disaccharides are sweet in taste. ii. They are easily soluble in water.

18. Give characteristics of oligosaccharides.

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans:** i. Disaccharides are white crystalline solids and sweet in taste.

ii. They are easily soluble in water.

19. Describe carbohydrates as source of energy. (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** Our body uses carbohydrates in the form of glucose. Glucose is the only form of carbohydrates that is used directly by muscles for energy. It is important to note that brain needs glucose as an energy source, because it cannot use fat for this purpose.

20. Define reducing sugar with example.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans. Reducing Sugar:** Monosaccharides are white crystalline solids. They are soluble in water and have sweet taste. They cannot be hydrolyzed. They are reducing in nature, therefore, these are called reducing sugars.

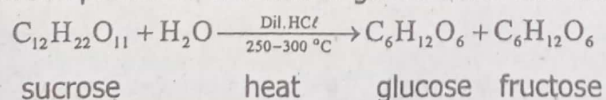
**Examples:** Glucose

21. Give an example of Disaccharide. How it is Hydrolyzed into Monosaccharides?

(SGD-I/II, DGK-II, SWL-II)

**Ans.** The most important oligosaccharides are disaccharides like sucrose.

On hydrolysis, sucrose produces one unit of glucose and one unit of fructose.





39. Which acid is present in apples?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Malic acid is present in apples.

40. Name the acids present in rancid butter and citrus fruits.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Butyric acid is present in rancid butter, While citric acid is present in citrus fruits.

41. Name the acids present in vinegar and citrus fruit.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Acetic acid is present in vinegar while citric acid is present in citrus fruit.

42. Write formula of Calcium Hydroxide. Also describe its one use.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Formula of Calcium hydroxide:  $\text{Ca(OH)}_2$

Use: Calcium hydroxide is used to make bleaching powder and to soften hard water.

43. Write chemical formula and use of Ammonium hydroxide.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Chemical Formula:  $\text{NH}_4\text{OH}$

Use of Ammonium hydroxide: It is used to remove grease stains from clothes.

44. Write two preventions from hyperacidity. (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: The best prevention from hyperacidity is:

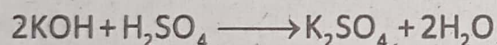
- Avoiding over-eating and staying away from fatty acids and spicy foods.
- Simple and regular eating, remaining in an upright position for about 45 minutes after taking a meal.

45. Write any two chemical properties of bases.

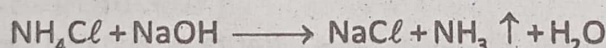
(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans: Chemical properties of Bases:

- Bases react with acids to form salt and water.



- Bases react with ammonium salt to liberate ammonia gas.



46. Write down formulas of the following.

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

(a) Nitric acid

(b) Phosphoric acid

(c) Calcium Hydroxide

(d) Aluminium Hydroxide

Ans:

| Compound                | Chemical Formula        |
|-------------------------|-------------------------|
| (a) Nitric Acid         | $\text{HNO}_3$          |
| (b) Phosphoric Acid     | $\text{H}_3\text{PO}_4$ |
| (c) Calcium Hydroxide   | $\text{Ca(OH)}_2$       |
| (d) Aluminium Hydroxide | $\text{Al(OH)}_3$       |

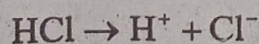
## 10.2

### pH Scale

47. A solution of HCl is 0.01M. What is its pH value?

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Solution: Hydrochloric acid is a strong acid so it ionizes completely i.e.



so, its solution contains 0.01 M  $\text{H}^+$  ions i.e.  $10^{-2}$  M



$$\text{pH} = -\log [\text{H}^+]$$

By putting values of  $\text{H}^+$  ions in above equation

$$\text{pH} = -\log 10^{-2}$$

$$\text{pH} = 2.$$

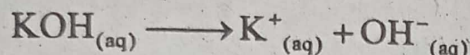
**48. Why pure water is not a strong electrolyte?** (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans:** Pure water is not a strong electrolyte because it ionizes very slightly into ions in the process called auto ionization or self ionization.

**49. Find out the pOH of 0.001M solution of KOH.**

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans:** pH of 0.001 M KOH solution



$$[\text{OH}^-] = 0.001\text{M}$$

$$\text{pOH} = -\log [\text{OH}^-]$$

$$= -\log (0.001) = -\log (10^{-3})$$

$$\text{pOH} = -(-3) \log 10$$

$$= +3 \log 10 \quad (\log 10=1)$$

$$\text{pOH} = 3 (1) = 3$$

**50. Define pH scale. Write its range.** (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** **pH scale:** A scale is developed with the reference of following equation according to the molar concentration of  $\text{H}^+$  ions that is called pH scale. It ranges for 0 to 14.

$$\text{pH} = -\log [\text{H}^+]$$

**51. What is the purpose of pH meter?** (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** The pH of a solution can be measured with a pH meter. Its electrode is dipped into the solution and the meter shows the pH either on scale or digitally. It is more reliable and accurate method of measuring pH than Universal indicator paper.

**52. Write the names of two indicators which are used in titration.**

(SGD-I/II, DGK-II, SWL-II)

**Ans:** Indicators used in titration are as follows:

- i) Methyl orange                      ii) Phenolphthalein

**53. How pH of a solution is measured by using universal indicator?**

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans.** Some indicators are used as mixtures. The mixture indicators give different colours at different pH values. Universal indicator paper is dipped in solution and its color is compared with standard chart to measure pH values. Such a mixed indicator is called universal indicator or simply pH indicator.

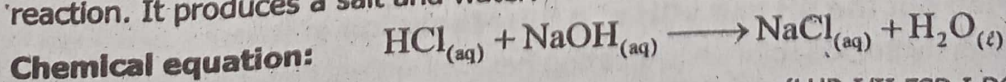
## 10.3

### Salts

**54. What is neutralization reaction? Write a chemical equation as well.**

(RWP-GI, DGK-GI, MTN-GI)

**Ans: Neutralization reaction:** A reaction between an acid and a base is called a neutralization reaction. It produces a salt and water.



(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

**55. How are the salts named?**

**Ans:** The salt gets its name from the names of the metal and the acid.

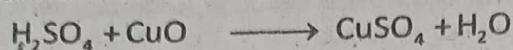


| Metal         | Acid                            | Salt name                             |
|---------------|---------------------------------|---------------------------------------|
| Sodium (Na)   | Hydrochloric acid (HCl)         | Sodium chloride (NaCl)                |
| Potassium (K) | Nitric acid (HNO <sub>3</sub> ) | Potassium nitrate (KNO <sub>3</sub> ) |

56. How salt is prepared by the reaction of an acid and metallic oxide.

(SGD-I/II, DGK-II, SWL-II)

Ans: Mostly the insoluble metallic oxides react with dilute acids to form salts and water.

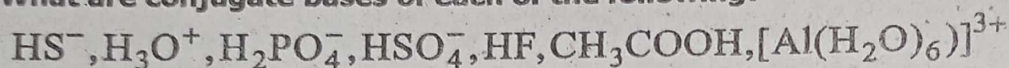


## 10.4

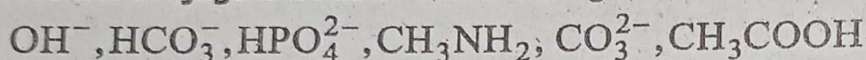
## Problems

### Problem 10.1:

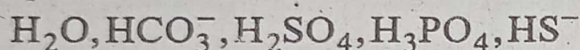
(a) What are conjugate bases of each of the following?



(b) Give the conjugate acids of the following:



(c) Which of the following behave both as Bronsted acids and Bronsted bases?



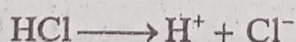
Solution:

| (a)                                      | Conjugate bases                                   | (b)                      | Conjugate acids              |
|--|---|--------------------------|------------------------------|
| $\text{HS}^-$                            | $\text{S}^{2-}$                                   | $\text{OH}^-$            | $\text{H}_2\text{O}$         |
| $\text{H}_3\text{O}^+$                   | $\text{H}_2\text{O}$                              | $\text{HCO}_3^-$         | $\text{H}_2\text{CO}_3$      |
| $\text{HF}$                              | $\text{F}^-$                                      | $\text{CH}_3\text{NH}_2$ | $\text{CH}_3\text{NH}_3^+$   |
| $\text{H}_2\text{PO}_4^-$                | $\text{HPO}_4^{2-}$                               | $\text{HPO}_4^{2-}$      | $\text{H}_2\text{PO}_4^-$    |
| $\text{HSO}_4^-$                         | $\text{SO}_4^{2-}$                                | $\text{CO}_3^{2-}$       | $\text{HCO}_3^-$             |
| $\text{CH}_3\text{COOH}$                 | $\text{CH}_3\text{COO}^-$                         | $\text{CH}_3\text{COOH}$ | $\text{CH}_3\text{COOH}_2^+$ |
| $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$ | $[\text{Al}(\text{H}_2\text{O})_5\text{OH}]^{2+}$ |                          |                              |

(c) Bronsted acids, as well as, bases are:  $\text{H}_2\text{O}, \text{HCO}_3^-, \text{HS}^-$

**Problem 10.2:** A solution of Hydrochloric acid is 0.01M. What is its pH value?

**Solution:** Hydrochloric acid is a strong acid so it ionizes completely. That is,



So, its solution also contains 0.01 M  $\text{H}^+$  ions in the equation i.e.,  $10^{-2}\text{M}$

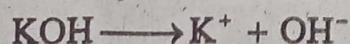
$$\text{pH} = -\log[\text{H}^+]$$

$$\text{pH} = -\log[10^{-2}]$$

$$\text{pH} = 2$$

**Problem 10.3:** Find out the pH and pOH of 0.001M solution of KOH?

**Solution:** Potassium hydroxide solution is a strong base. It ionizes completely such that one mole of KOH gives one mole of  $\text{OH}^-$  ions.





Therefore, 0.001M solution of KOH produced 0.001M OH<sup>-</sup> ions.

$$[\text{OH}] = 0.001\text{M} = 10^{-3}\text{M}$$

$$\text{pOH} = -\log[\text{OH}^-]$$

$$\text{pOH} = -\log 10^{-3} = 3$$

$$\text{pH} + \text{pOH} = 14$$

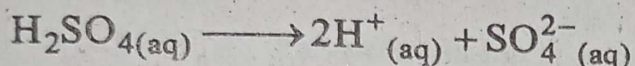
$$\text{pH} = 14 - \text{pOH} = 14 - 3$$

$$\text{pH} = 11$$

**Problem 10.4 Find the pH of 0.01M sulphuric acid?**

**Solution:**

Sulphuric acid is a strong dibasic acid. It ionizes completely and its one mole produces 2 moles of hydrogen ions as presented in equation.



Therefore, 0.01M sulphuric acid will produce  $2 \times 0.01\text{M}$  hydrogen ions.

Hence, hydrogen ions concentration is

$$[\text{H}^+] = 2 \times 10^{-2}\text{M}$$

$$\text{pH} = -\log [\text{H}^+]$$

$$\text{pH} = -\log(2 \times 10^{-2}) = -(\log 2 + \log 10^{-2})$$

$$\text{pH} = -\log 2 - \log 10^{-2} \quad \text{as } -\log 10^{-2} = 2$$

$$\text{pH} = 2 - \log 2 \quad \text{pH} = 2 - 0.3 = 1.7$$

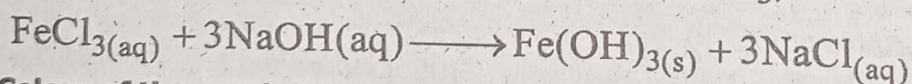
### Solved Exercise

#### Multiple Choice Questions

- A base is a substance which neutralizes an acid. Which of these substances not a base?**
  - Aqueous ammonia
  - Sodium chloride
  - Sodium carbonate
  - Calcium oxide
- Lewis acid-base concept have the following characteristics except:** (RWP-II)(ALP)
  - Formation of an adduct
  - Formation of a co-ordinate covalent bond.
  - Donation and acceptance of an electron pair
  - Donation and acceptance of a proton.
- Acetic acid is used for:** (RWP-I, BWP-I)(ALP)
  - Flavouring food
  - Making explosives
  - Etching designs
  - Cleaning metals
- A salt is not composed of:**
  - A metallic cation
  - Non-metallic anion.
  - An anion of base
  - An anion of an acid
- If a liquid has a pH of 7 then it must:**
  - Be a colourless and odourless liquid
  - Freeze at 0°C and boils at 100°C
  - Be neutral
  - Be a solution containing water.
- A salt always:**
  - Contains ions
  - Contains water of crystallization
  - Dissolves in water
  - forms crystals which conduct electricity



7. Dilute acids react with carbonates to produce the given products except:  
(a) Salt (b) Water (c) Carbon dioxide (d) Hydrogen
8. In the preparation of insoluble salts, which one of the facts is incorrect?  
(a) Two soluble salts are mixed (b) Ions of both salts are exchanged  
(c) One of the salts produced is insoluble (d) Both of the salts produced are insoluble
9. A reaction between an acid and a base produces: (SWL-I, DGK-I)(ALP)  
(a) Salt and water (b) Salt and gas (c) Salt and an acid (d) Salt and a base
10. The conjugate acid of  $\text{HPO}_4^{2-}$  is: (MLT-I, SRG-II)(ALP)  
(a)  $\text{PO}_4^{3-}$  (b)  $\text{H}_2\text{PO}_4^{2-}$  (c)  $\text{H}_2\text{PO}_4^-$  (d)  $\text{H}_2\text{PO}_4$
11. What is the pOH of a 0.02M  $\text{Ca(OH)}_2$ ? (MLT-I, GUJ-I, DGK-II, FSD-I)(ALP)  
(a) 1.698 (b) 1.397 (c) 12.31 (d) 12.61
12. Which one of the following species is not amphoteric?  
(a)  $\text{H}_2\text{O}$  (b)  $\text{NH}_3$  (c)  $\text{HCO}_3^-$  (d)  $\text{SO}_4^{2-}$
13. The product of Lewis acid-base reaction is called adduct. The bond between the adduct species is:  
(a) ionic (b) covalent  
(c) metallic (d) co-ordinat covalent
14. The water of crystallization is responsible for the:  
(a) Melting points of crystals (b) Boiling points of crystals.  
(c) Shapes of crystals (d) Transition points of crystals
15. You want to dry a gas which one of the following salts you will use:  
(a)  $\text{CaCl}_2$  (b)  $\text{NaCl}$  (c)  $\text{CaO}$  (d)  $\text{Na}_2\text{SiO}_3$
16. Ferric hydroxide  $\text{Fe(OH)}_3$  is precipitated out of solution when aqueous sodium hydroxide solution is added to ferric chloride ( $\text{FeCl}_3$ ).



Colour of the precipitate is:

- (a) white (b) blue (c) dirty green (d) brown
17. Which ion is the conjugate base of sulphuric acid?  
(a)  $\text{SO}_4^{2-}$  (b)  $\text{S}^{2-}$  (c)  $\text{HSO}_3^-$  (d)  $\text{HSO}_4^-$
18. Which one of the following is a Lewis base?  
(a)  $\text{NH}_3$  (b)  $\text{BF}_3$  (c)  $\text{H}^+$  (d)  $\text{AlCl}_3$
19. According to the Lewis concept, acid is a substance which can:  
(a) Donate a proton (b) Donate a pair of electron  
(c) Accept a proton (d) Accept a pair of electron
20. Given  $K_w = [\text{H}^+][\text{OH}^-] = 1 \times 10^{-14}$  at  $25^\circ\text{C}$ :  
What is the concentration of  $\text{H}^+$  in pure water at  $25^\circ\text{C}$ ?  
(a)  $1 \times 10^{-7} \text{ mol dm}^{-3}$  (b)  $1 \times 10^7 \text{ mol dm}^{-3}$   
(c)  $1 \times 10^{-14} \text{ mol dm}^{-3}$  (d)  $1 \times 10^{14} \text{ mol dm}^{-3}$



## Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | B | 2  | D | 3  | A | 4  | C | 5  | C |
| 6  | A | 7  | D | 8  | D | 9  | A | 10 | C |
| 11 | B | 12 | B | 13 | D | 14 | C | 15 | C |
| 16 | D | 17 | D | 18 | A | 19 | D | 20 | A |

## Short Questions

1. Name the common household substances having.

(a) pH value greater than 7.

Ans. (i) Mint (ii) Milk of magnesia  $Mg(OH)_2$   
(iii) Caustic soda  $NaOH$

(b) pH value less than 7.

Ans. (i) Potatoes (ii) Sour Milk (Lactic acid)  
(iii) Apple (Malic acid)

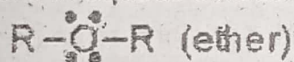
(c) pH value equal to 7.

Ans. (i) Water  $H_2O$  (ii) Table salt solution  $NaCl$   
(iii) Calcium chloride  $CaCl_2$

2. Define a base and explain all alkalies are bases, but all bases are not alkalies.

Ans. According to different acid-base theories, Base is a substance that has capacity to release  $OH^-$  ions in aqueous solution, accept a proton and donate electron pair. While the term alkali is specifically limited to its capacity of releasing  $OH^-$  ions in aqueous solution, acting as a soluble base. So on basis of above mentioned facts, it can be concluded that all alkalies are bases but all bases are not alkalies.

**For example:** As all alkalies are bases, so  $NaOH$  (alkali) acts also as a base and gives  $OH^-$  ions in aqueous solution. While all the bases are not alkalies.

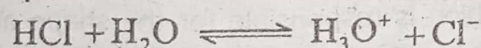


which meets criteria of base by donating electron pair or accepting proton is not an alkali as it is not water soluble and does not give  $OH^-$  in aqueous solution.

3. Define Bronsted-Lowry base and explain with an example that water is a Bronsted-Lowry base.

Ans. According to Bronsted-Lowry a base is a substance that can accept a proton from another substance.

When  $HCl$  is dissolved in water,  $H_2O$  acts as a base as it accepts proton from  $HCl$  to form hydronium ion.



So,  $HCl$  is an acid as it donates a proton, where as  $H_2O$  is a base as it accepts a proton.

4. How can you justify that Bronsted-Lowry concept of acid and base is applicable to non-aqueous solutions?

Ans. According to Bronsted-Lowry a base is a substance that can accept a proton ( $H^+$ ) from another substance while an acid is a substance that can donate a proton ( $H^+$ ) to another substance.

The compounds which have  $H^+$  ions also acts as acid in addition to water e.g.,  $HCl$  while the compound which has no  $OH^-$  ions also act as base e.g.,  $NH_3$  acts as a base according to Bronsted-Lowry concept as it can accept a proton. Its basic nature is not dependent upon aqueous medium as it has no  $OH^-$  ions to provide. For this there is no need of aqueous solution or aqueous medium. So it can be said that Bronsted-Lowry concept of acid and base is applicable to non aqueous medium.

5. Which kind of bond forms between a Lewis acid and a base?

Ans. A bond which is formed in Lewis acid and a Lewis base is co-ordinate covalent bond.



**6. Why  $H^+$  ion acts as a Lewis acid?**

(SWL-I)(ALP)

**Ans.** According to Lewis, acid is a substance which can accept a pair of electrons.  $H^+$  is an electron deficient due to its empty orbital. So it can accept a pair of electron to complete its valence shell.

**7. Name two acids used in the manufacturing of fertilizers.**

**Ans.** Sulphuric acid  $H_2SO_4$  and Nitric acid  $HNO_3$  are used in the preparation of fertilizers.

**8. Define pH. What is the pH of pure water?**

(BWP-I,MLT-I,FSD-I)(ALP)

**Ans.** pH is the negative logarithm of molar concentration of the hydrogen ions.

$$pH = -\log[H^+]$$

The pH of pure water is 7.

**9. How many times a solution of pH 1 will be stronger than that of a solution having pH 2?**

(BWP-II,LHR-I)(ALP)

**Ans.** A solution of pH 1 has 10times higher concentration of  $[H^+]$  than that of a solution of pH 2.

**10. Define the following:**

i. Normal salt

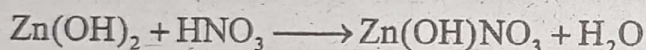
ii. Basic salt

**Ans. Normal Salt:**

A salt formed by the total replacement of ionizable  $H^+$  ions of an acid by a positive metal ion or  $NH_4^+$  ions is called normal or neutral salt. These salts are neutral to litmus, that is,



**Basic Salts:** Basic salts are formed by the incomplete neutralization of a polyhydroxy base by an acid.

**11.  $Na_2SO_4$  is a neutral salt while  $NaHSO_4$  is an acidic salt. Justify.**

**Ans.**  $Na_2SO_4$  is a salt formed by the total replacement of ionized  $H^+$  ions of an acid by a positive metal ion. Therefore it is called normal salt.

$NaHSO_4$  is a acidic salt because it is formed by partial replacement of a replaceable ions of an acid by a positive metal ion. This is the reason it is a acidic salt.

**12. Give a few characteristic properties of salts.**

**Ans. Characteristic properties of salts:**

- Salts are ionic compounds found in crystalline form.
- They have high melting and boiling points.
- Most of the salts contain water of crystallization which is responsible for the shape of the crystals. For example, Copper sulphate  $CuSO_4 \cdot 5H_2O$  has 5 water of crystallization.
- Salts are neutral compounds.

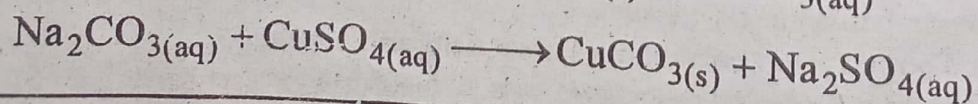
**13. How the soluble salts are recovered from water?**

**Ans.** Soluble salts are often prepared in water. And they are recovered by evaporation or crystallization process.

**14. How are the insoluble salts prepared?**

**Ans. Preparation of insoluble salts:**

In this method, usually solutions of soluble salts are mixed. During the reaction exchange of ionic radicals (i.e., metallic radicals) takes place to produce two new salts. One of the salts is insoluble and the other is soluble. The insoluble salt precipitates (solidify in solution).





15. Why a salt is neutral, explain with an example?

Ans. Salts are neutral compounds. Although, they do not compose of equal number of positive and negative ions, but have equal number of positive and negative charges. NaCl is a neutral salt. Because  $\text{Na}^+$  is a positive ion and  $\text{Cl}^-$  is a negative charge carrier. Both charges are equal.

16. Name an acid used in preservation of food.

Ans. Benzoic acid is used for the preservation of food.

17. Name the acids present in:

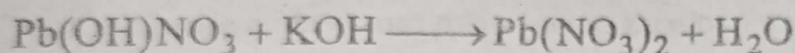
i. Vinegar      ii. Ant sting      iii. Citrus fruit      iv. Sour milk

Ans. i. Acetic acid      ii. Formic acid      iii. Citric acid      iv. Lactic acid

18. How can justify that  $\text{Pb}(\text{OH})\text{NO}_3$  is a basic salt?

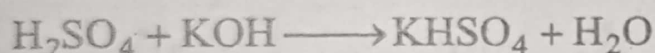
Ans.  $\text{Pb}(\text{OH})\text{NO}_3$  is a basic salt as:-

- It has replaceable hydroxide ion which gives clue about basic salt.
- It undergoes neutralization process by reaction with acid.



19. You are in a need of an acidic salt. How can you prepare it?

Ans. Acidic salts are formed by partial replacement of a replaceable  $\text{H}^+$  ions by a positive metal ion.



20. Which salt is used to prepare plaster of paris?

Ans. Calcium sulphate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) is used to prepare plaster of Paris.

### Extensive Questions

1. Define pH. Write its three uses.

[RWP-GI-21][MTN-GII-21][BWP-GI-21](ALP)

Ans. pH Scale:

Concentration of hydrogen ion  $[\text{H}^+]$  in pure water is the basis for the pH scale.

$$\text{pH} = -\log[\text{H}^+]$$

Uses of pH:

- pH is used to determine acidic or basic nature of solution.
- pH is used to produce medicines, culture at a microbiological particular concentration of  $\text{H}^+$  ion.
- pH is used to prepare solutions of require concentration necessary for certain biological reactions.

2. Define salt explain with examples how soluble salts are prepared and Also write the characteristics of salts.

[DGK-GII-21][SWL-21][MTN-GI-21](ALP)

Ans. Salts: Salts are ionic compounds generally formed by the neutralization of an acid with a base. For example NaCl and  $\text{KNO}_3$ .

Salts are made up of positive ions (cations) and negative ions (anions). A cation is metallic and derived from a base, therefore, it is called basic radical. An anion is derived from acids therefore it is called acid radical.

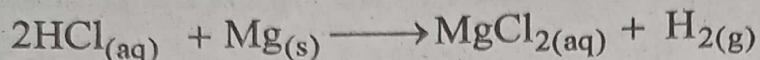
Characteristic properties of salts:

- Salts are ionic compound
- They are found in crystalline form.
- They have high Melting and boiling points.
- Salts are neutral compounds. They have equal number of positive and negative charges.

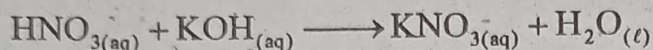


**Preparation of Soluble Salts:**

- (i) **By the reaction of an acid and a metal:** (Direct displacement method)  
This is direct displacement method in which hydrogen ion of acid is replaced by a reactive metal. Such as calcium, magnesium, Zinc and Iron, e.g.



- (ii) **By the reaction of an acid and a base:** (Neutralization method):  
It is a neutralization reaction in which acid and base react to produce a salt and water.



- (iii) **By the reaction of an acid and metallic oxide:**  
Mostly the insoluble metallic oxides react with dilute acids to form salt and water.

**3. Explain the lewis concepts of acids and bases.**

[SGD-GII-21](ALP)

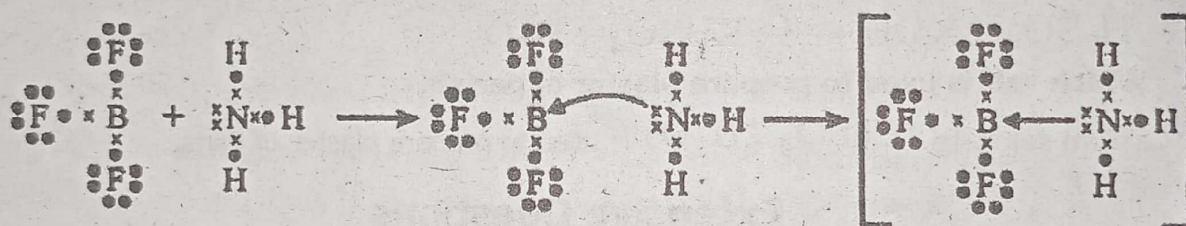
**Ans. Lewis Acid:**

An Acid is a substance (molecule or ion) which can accept a pair of electrons.

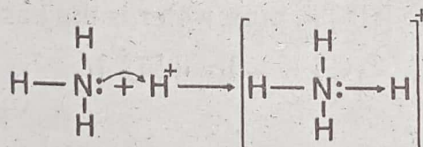
**Lewis Base:** A base is a substance (molecule or ion) which can donate a pair of electrons.

For example:  $\text{Cl}^-$ ,  $\text{OH}^-$ ,  $\text{H}_2\ddot{\text{O}}$ ,  $\ddot{\text{N}}\text{H}_3$

Example:- For example a reaction between ammonia ( $\text{NH}_3$ ) and Boron trifluoride takes place by donating an electron pair of ammonia and accepting that electron pair by boron trifluoride.



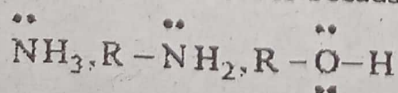
- (ii) When  $\text{H}^+$  and  $\text{NH}_3$  react together they form  $\text{NH}_4^+$  in this reaction  $\text{NH}_3$  is a base and  $\text{H}^+$  act as acid.

**Characteristics of Lewis acids:**

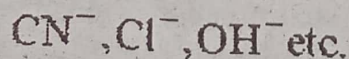
- (i) Molecules in which the central atom has incomplete octet. For example, in  $\text{BF}_3$ ,  $\text{AlCl}_3$ ,  $\text{FeCl}_3$ , the central atom has only six electrons around it, therefore, these can accept an electron pair.
- (ii) Simple cations can act as Lewis acids. All cations act as Lewis acids since they are deficient in electrons. However, cations such as  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$  ions, etc, have very little tendency to accept electrons. While the cations like  $\text{H}^+$ ,  $\text{Ag}^+$  ions, etc, have a greater electron accepting tendency therefore, act as Lewis acids.

**Characteristics of Lewis bases:**

- (i) Neutral species having at least one lone pair of electrons. For example, ammonia amines, alcohols etc., act as Lewis bases because they contain a lone pair of electrons:



- (ii) Negatively charged species or anions. For example, chloride, cyanide, hydroxide ions, etc. as Lewis bases:

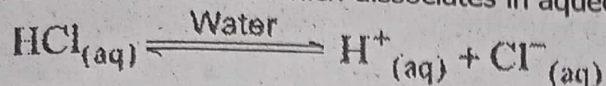




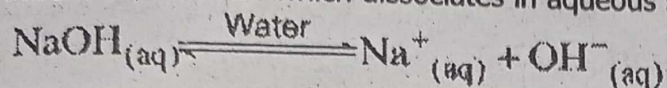
4. Describe Arrhenius concept of acids and bases, Give examples. [DGK-GI-21](ALP)

Ans. Arrhenius concept of acids:

Acid is a substance which dissociates in aqueous solutions to give hydrogen ions.



Base is a substance which dissociates in aqueous solution to give hydroxide ions.



**Limitation of Arrhenius Concept:**

- This concept is applicable only in aqueous medium and does not explain nature of acids and bases in non-aqueous medium.
- According to this concept, acids and bases are only those compounds which contain hydrogen ( $\text{H}^+$ ) and hydroxyl ( $\text{OH}^-$ ) ions, respectively. It can not explain the nature of compounds like  $\text{CO}_2$ ,  $\text{NH}_3$  etc, which are acid and bases, respectively.

5. Define acid and base according to Bronsted-Lowry concept and justify with examples that water is an amphoteric compounds. [GUJ-GI-21][RWP-GII-21](ALP)

Ans. Bronsted-Lowry concept:

In 1923, the Danish chemist Bronsted and the English chemist Lowry independently presented their theories of acids, bases on the basis of proton-transfer.

**Acid:**

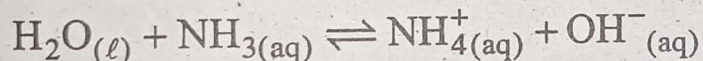
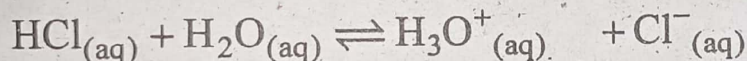
According to Bronsted-Lowry concept "An Acid is a substance (molecule or ion) that can donate a proton ( $\text{H}^+$ ) to another substance. For example  $\text{HCl}$ ,  $\text{HNO}_3$  and  $\text{CH}_3\text{COOH}$ .

**Base:**

A base is a substance that can accept a proton ( $\text{H}^+$ ) from another substance.

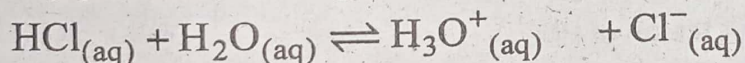
For example  $\text{H}_2\text{O}$  and  $\text{NH}_3$ .

**Exaples:**



**Conjugate Acid:** Conjugate acid is a species formed by acceptance of a proton ( $\text{H}^+$ ) by a base.

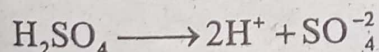
**Conjugate base:** Conjugate base is a species formed when an acid donates a proton.  $\text{OH}^-$  is conjugate base of acid  $\text{H}_2\text{O}$ .



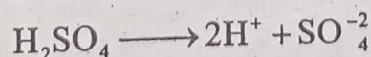
### Numericals

1. Calculate the pH and pOH of  $0.2\text{M H}_2\text{SO}_4$ ?

**Solution:** Sulphuric acid is a strong acid. It ionized completely. Its 1 mole produce two  $\text{H}^+$  ions. As shown in balanced chemical equation.



If the  $\text{H}_2\text{SO}_4$  is  $0.2\text{M}$ , then the concentration of  $\text{H}^+$  as.



$$[\text{H}_2\text{SO}_4] = 0.2\text{M}$$

$$[\text{H}^+] = 2 \times 0.2 = 0.4\text{M} = 4 \times 10^{-1}\text{M}$$

$$\text{pH} = -\log[\text{H}^+]$$

$$\text{pH} = -\log[4 \times 10^{-1}]$$



$$\text{pH} = -\log 4 - (-1) \log 10$$

$$= -0.6 + 1 = 0.4$$

We know that:

$$\text{pH} + \text{pOH} = 14$$

$$\text{pOH} = 14 - \text{pH}$$

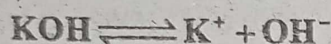
$$\text{pOH} = 14 - 0.4 = 13.6$$

2. Calculate the pH of 0.1 M KOH?

Solution:

First of all we have to find out the pOH value of 0.1 M KOH. KOH is a stronger base. It ionized completely and produce one mole of KOH produce 1 mole of ions as.

From balanced chemical equation:



So, 0.1 mole of KOH produce 0.1  $\text{OH}^-$  ions are produced.

$$[\text{OH}^-] = 0.1\text{M or } 10^{-1}\text{M}$$

We know that

$$\text{pOH} = -\log[\text{OH}^-]$$

$$\text{pOH} = -\log[10^{-1}]$$

$$\text{pOH} = 1$$

Now find out the value of pH as.

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} = 14 - \text{pOH}$$

$$\text{pH} = 14 - 1$$

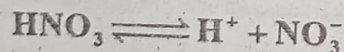
$$\text{pH} = 13$$

$$\boxed{\text{pH} = 13}$$

3. Calculate the pOH of 0.004 M  $\text{HNO}_3$ ?

Solution: First of we have to find out the pH of  $\text{HNO}_3$ .

Nitric acid is a strong acid. It ionized completely. One mole of  $\text{HNO}_3$  produce one mole of ions. As shown in balanced chemical equation.



As,  $[\text{H}^+] = 0.004\text{M or } 4 \times 10^{-3}\text{M}$

$$\text{pH} = -\log[\text{H}^+]$$

$$= -\log(4 \times 10^{-3})$$

$$= (\log 4 + \log 10^{-3})$$

$$= -\log 4 - \log 10^{-3}$$

$$= -\log 4 + 3$$

$$= 3 - \log 4$$

$$= 3 - 0.602$$

$$\text{pH} = 0.398$$

$$\text{pH} = \boxed{2.4}$$



Or

$$pOH = -\log[0.004]$$

$$pOH = +2.398$$

$$pOH = 2.4$$

Now find out the value of pOH as  $pH + pOH = 4$

$$pOH = 14 - pH$$

$$pOH = 14 - 2.398$$

$$pOH = 11.602$$

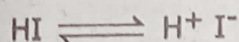
4. Complete the following table

|       | Solution                   | $[H^+]$             | $[OH^-]$            | pH    | pOH   |
|-------|----------------------------|---------------------|---------------------|-------|-------|
| (i)   | 0.15M HI                   | $15 \times 10^{-2}$ | —                   | 0.82  | 13.4  |
| (ii)  | 0.040M KOH                 | —                   | $4 \times 10^{-2}$  | 12.6  | 1.4   |
| (iii) | 0.020M Ba(OH) <sub>2</sub> | —                   | $4 \times 10^{-2}$  | 12.6  | 1.4   |
| (iv)  | 0.00030M HClO <sub>4</sub> | $3 \times 10^{-4}$  | —                   | 3.52  | 10.48 |
| (v)   | 0.55 M NaOH                | —                   | $55 \times 10^{-2}$ | 13.74 | 0.26  |
| (vi)  | 0.055M HCl                 | $55 \times 10^{-3}$ | —                   | 1.26  | 12.74 |
| (vii) | 0.055M Ca(OH) <sub>2</sub> | —                   | $11 \times 10^{-2}$ | 13.04 | 0.96  |

This table is completed on the basis of following calculations:

**Solution:**

(i) 0.15 M HI



0.15 hydrogen iodide (HI) release one  $H^+$  ion as...

$$[H^+] = 1 \times 0.15 \text{ or}$$

$$H^+ = 15 \times 10^{-2}$$

$$pH = -\log(15 \times 10^{-2})$$

$$pH = 0.82$$

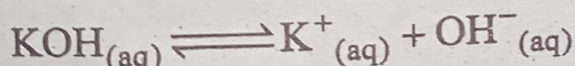
$$pOH + pH = 14$$

$$pOH = 14 - 0.82$$

$$pOH = 13.12$$

(ii) 0.040 M KOH

KOH is a strong base which can ionize completely. One mole of KOH produces one OH ion as shown in balanced chemical equation:



$$OH^- = 1 \times 0.040$$

$$OH^- = 4.0 \times 10^{-2}$$

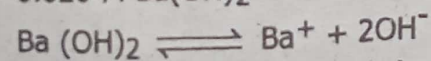
$$pOH = -\log(4.0 \times 10^{-2})$$

$$pOH = 1.40$$

$$pOH + pH = 14$$

$$pH = 14 - pOH = 14 - 1.40 = 12.60$$

(iii) 0.020 M Ba(OH)<sub>2</sub>



Ba(OH)<sub>2</sub> releases two  $OH^-$  ions as shown in equation

$$OH^- = 2 \times 0.020$$



$$OH^- = 4 \times 10^{-2}$$

$$pOH = -\log(OH^-)$$

$$pOH = -\log(4 \times 10^{-2})$$

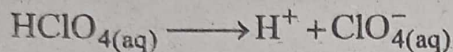
$$pOH = 1.40$$

$$pH + pOH = 14$$

$$pH = 14 - pOH = 14 - 1.40 = 12.6$$

(iv) 0.00030 M  $HClO_4$

$HClO_4$  releases one  $H^+$  ion as:



$$H^+ = 1 \times 3.0 \times 10^{-4}$$

$$H^+ = 3.0 \times 10^{-4}$$

$$pH = -\log[H^+]$$

$$pH = -\log[3.0 \times 10^{-4}]$$

$$pH = 3.52$$

$$pOH + pH = 14$$

$$pOH = 14 - pH$$

$$pH = 14 - 3.52 = 10.48$$

(v) 0.55 M NaOH



NaOH releases one ( $OH^-$ ) ion as:

$$OH = 1 \times 0.55$$

$$[OH^-] = 55.0 \times 10^{-2}$$

$$pOH = -\log[OH^-]$$

$$pOH = -\log(55.0 \times 10^{-2})$$

$$pOH = 0.26$$

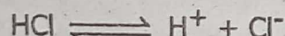
$$pH + pOH = 14$$

$$pH = 14 - pOH$$

$$pH = 14 - 0.26$$

$$pH = 13.74$$

(vi) 0.050 M HCl



HCl releases one  $H^+$  ion as.....

$$H^+ = 1 \times 0.055$$

$$H^+ = 55 \times 10^{-3}$$

$$pH = -\log[55 \times 10^{-3}] = 1.26$$

$$pH + pOH = 14$$

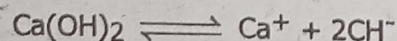
$$pH + pOH = 14$$

$$pOH = 14 - pH$$

$$pOH = 14 - 1.26$$

$$pH = 12.74$$

(vii) 0.055 M  $Ca(OH)_2$



$Ca(OH)_2$  releases two ( $OH^-$ ) ions as...

$$OH^- = 2 \times 0.055$$

$$OH^- = 0.11 \quad \text{or} \quad 11 \times 10^{-2}$$

$$pOH = -\log[11 \times 10^{-2}]$$

$$pOH = 0.96$$

$$pH + pOH = 14$$

$$pH = 14 - pOH$$

$$pH = 14 - 0.96 = 13.04$$



## Chapter 11 Organic Chemistry

All Punjab Past Board Papers  
2014 - 2021

## ALP Annual Paper 2021


## MCQ's

1. What is the molecular formula for butane?  
(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $C_4H_6$  (B)  $C_4H_{10}$  (C)  $C_4H_{12}$  (D)  $C_4H_8$
2. Formula of Acetaldehyde is: (BWP-I)  
(A)  $CH_3-CH_2OH$  (B)  $CH_3-C-OH$  (C)  $CH_3-\overset{\overset{O}{||}}{C}-H$  (D)  $H-C-H$
3. What is the formula of Octane?  
(GUJ-I)  
(A)  $C_8H_8$  (B)  $C_8H_{16}$  (C)  $C_8H_{18}$  (D)  $C_8H_{20}$

## 2014 - 2020

## 11.1

## Organic Compounds

4. The example of hetrocyclic compound is: [SGD-II, MTN-I, FSD-II, DGK-II]  
(A) benzene (B) hexane (C) cyclohexane (D) Pyridine
5. Benzene ring  is an exmample of:  
(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
(A) Alicyclic compound (B) Aromatic compound  
(C) Heterocyclic compound (D) Straight chain
6. The formula of Pentane is: (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $C_5H_{12}$  (B)  $C_5H_{10}$  (C)  $C_5H_8$  (D)  $C_5H_{14}$
7. The Formula of Decane is: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $C_{10}H_{20}$  (B)  $C_{10}H_{22}$  (C)  $C_{10}H_8$  (D)  $C_{10}H_{16}$
8. All known organic compounds have been broadly divided into categories depending upon their carbon skeleton: (SGD-I/II, DGK-II, SWL-II)  
(A) 1 (B) 2 (C) 3 (D) 4
9. Open chain compounds also called: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Acyclic (B) Cyclic (C) Covalent (D) Ionic
10. Open chain compounds are those in which the end carbon atoms are \_\_\_\_: (SGD-I/II, DGK-II, SWL-II)  
(A) Joined (B) One line (C) Two line (D) not joined
11. Open chain compounds also called: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Aliphatic (B) Cyclic (C) Covalent (D) Ionic
12. Cyclic compounds are divided into: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) 1 (B) 2 (C) 3 (D) 4
13. Homocyclic compounds are devided into: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) 2 (B) 4 (C) 6 (D) 8
14. Cyclobutane is an example of: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Alicyclic (B) Heterocyclic (C) Aromatic compounds (D) Covalent



15. Benzene ring consist of carbon atoms: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) 2 (B) 3 (C) 5 (D) 6
16. Cyclic compounds that contain one or more atoms other than that of carbon atoms in their rings are called \_\_\_\_\_: (SGD-I/II, DGK-II, SWL-II)  
 (A) Alicyclic (B) Heterocyclic (C) Aromatic compounds (D) Covalent

## 11.2

## Sources of Organic Compounds

17. How many percent of natural gas is consisted of . [GUJ-I, MTN-II, DGK-I, SWL-I]  
 (A) 82% (B) 83% (C) 84% (D) 85%
18. Wood contains the amount of carbon: [LHR-II, RWP-II, SGD-I, MTN-I, FSD-II, SWL-II]  
 (A) 40% (B) 50% (C) 60% (D) 70%
19. Main component of Natural Gas is: [GUJ-II, FSD-II, DGK-I, MTN-II, BWP-II]  
 (A) Methane (B) Propane (C) Butane (D) Propyne

## 11.3

## Uses of Organic Compounds

## 11.4

## Alkanes and Alkyl Radicals

## 11.5

## Functional Groups

## 11.6

## Functional Groups Test

20. Formula of alkyl radical is: [MTN-II, DGK-III, FSD-II]  
 (A)  $C_nH_{2n+2}$  (B)  $C_nH_{2n-2}$  (C)  $C_nH_{2n+1}$  (D)  $C_nH_{2n-1}$
21. Organic compounds are divided into groups of compounds having similar chemical properties. This group is known as: (SGD-I/II, DGK-II, SWL-II)  
 (A) Organic series (B) saturated compound  
 (C) Homologous series (D) Hetrologous series
22. The general formula of alkane is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $C_nH_{2n+2}$  (B)  $C_nH_{2n+1}$  (C)  $C_nH_{2n}$  (D)  $C_nH_{2n-2}$
23. The general formula of alkene is: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A)  $C_nH_{2n+2}$  (B)  $C_nH_{2n+1}$  (C)  $C_nH_{2n}$  (D)  $C_nH_{2n-2}$
24. The general formula of alkynes is: (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A)  $C_nH_{2n+2}$  (B)  $C_nH_{2n+1}$  (C)  $C_nH_{2n}$  (D)  $C_nH_{2n-2}$
25. Which one is carboxylic group? (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $>C=O$  (B)  $\begin{array}{c} O \\ || \\ -C-OH \end{array}$  (C)  $\begin{array}{c} O \\ || \\ R-C-OH \end{array}$  (D)  $\begin{array}{c} O \\ || \\ -C-H \end{array}$
26. Class formula of primary alcohol is: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A)  $R-CH_2-OH$  (B)  $\begin{array}{c} R \\ | \\ CH-OH \\ | \\ R \end{array}$  (C)  $\begin{array}{c} R \\ | \\ R-C-OH \\ | \\ R \end{array}$  (D)  $R-O-R$
27. Functional group of alcohols is: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A)  $-COOH$  (B)  $>C=O$  (C)  $C-O-C$  (D)  $-OH$



28. Which one of the following compounds is ketone? (SGD-I/II, DGK-II, SWL-II)  
 (A)  $(CH_3)_2CHOH$  (B)  $(CH_3)_2CO$  (C)  $(CH_3)_2NH$  (D)  $(CH_3)_2CHCl$
29. Class formula of tertiary alcohol is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $R-O-R$  (B)  $\begin{array}{c} R \\ | \\ R-C-OH \\ | \\ R \end{array}$  (C)  $\begin{array}{c} R \\ | \\ CH-OH \\ | \\ R \end{array}$  (D)  $R-CH_2-OH$
30. Test for unsaturation is: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A) Sodium metal test (B) Baeyer's test  
 (C) Bromine test (D) Ester test

### Answers

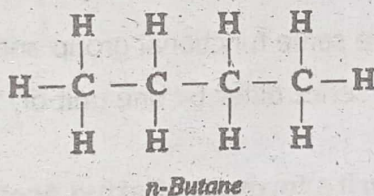
|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | B | 2  | C | 3  | C | 4  | D | 5  | B | 6  | A | 7  | B | 8  | B | 9  | A | 10 | D |
| 11 | A | 12 | B | 13 | A | 14 | A | 15 | D | 16 | B | 17 | D | 18 | A | 19 | A | 20 | C |
| 21 | C | 22 | A | 23 | C | 24 | D | 25 | B | 26 | A | 27 | D | 28 | B | 29 | B | 30 | C |

### ALP Annual Paper 2021

#### Short Questions

1. Define structural formula. (BWP-GI, SWL-GII, GUJ-GI, GII, MTN-GI)  
**Ans: Structural Formula:** Structural formula of a compound represents the exact arrangement of the different atoms of various elements present in a molecule of a substance.

**Example:**



2. Define organic chemistry. (DGK-GI, SGD-GI, DGK-GI)  
**Ans:** The branch of chemistry which deals with the study of hydrocarbons and their derivatives is known as organic chemistry.
3. Define condensed formula with an example. (LHR-I/II, MUL-I, SGD-II, DGK-I/II, SWL-I/II)  
**Ans: Condensed formula:** The formula that indicates the groups of atoms joined together to each carbon atom in a straight chain or a branched chain is called the condensed formula.
- Example:** Butane  $CH_3(CH_2)_2CH_3$
4. Define molecular formula and write the formula of hexane. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-I)

**Ans. Molecular Formula:**

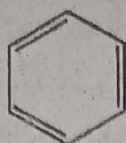
The formula which represents the actual number of atoms in one molecule of organic compound is called molecular formula.

**Example:** Molecular formula of butane is  $C_4H_{10}$ .

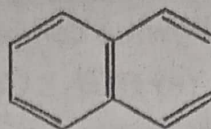
5. What are Aromatic Compounds? Give an example. (FSD-GI, II, MTN-GII, SDG-GI, DGK-GI, BWP-GII)

**Ans: Aromatic compounds:** These organic compounds contain at least one benzene ring in their molecule. A benzene ring is made up of six carbon atoms with three alternating double bonds. They are called aromatic because of aroma or smell they have.





Benzene



Naphthalene

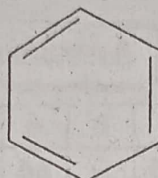
For example:

6. What are closed chain compounds? Give an example.

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans: Closed chain or cyclic compounds:** Closed chain or cyclic compounds contain one or more closed chains, i.e. the carbon atoms at the end of the chain are not free.

**Example:**



Benzene

7. Define open chain or acyclic compounds. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans: Open chain or acyclic compounds:**

These compounds contain open chains of carbon atoms in their molecules.

**Examples:**  $\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

Straight chain (n-Butane)

8. Write any two properties of homologous series.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:**

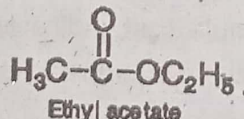
- All members of a series have same functional group and same chemical properties.
- Successive members of the series differ by one unit of  $-\text{CH}_2-$  and 14 units in their relative molecular mass.

9. What is ester linkage? write formula of ethyl acetate.

(BWP-I, LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans: Ester Linkage:** Organic compounds consisting of  $\text{RCOOR}'$  functional group are called esters. Their general formula is  $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR}'$ . R and R' are alkyl groups.

**Formula of Ethyl acetate:**



10. What is alcoholic functional group. Give examples (LHR-GI, RWP-GI, SWL-GI)

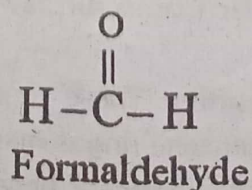
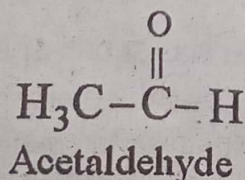
**Ans: Alcoholic Functional Group:** The functional group of alcohol is  $-\text{OH}$ , their general formula is  $\text{ROH}$ . Where R is an alkyl group.

For example  $\text{CH}_3\text{OH}$  (Methyl alcohol)

11. Give formulae of Formaldehyde and Acetaldehyde.

(LHR-I/II, MUL-I, SGD-I/II, DGK-I/II, SWL-I/II)

**Ans:**

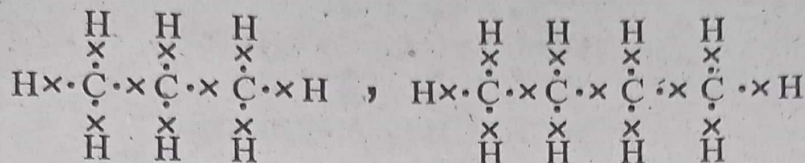




12. Write down the dot and cross formula of propane and n Butane.

[FSD-II,DGK-I,BWP-II,SWL-I/II]

Ans:



Propane

n-Butane

13. Give two examples of open chain organic compounds. [MTN-II,FSD-II,DGK-I,SWL-IGUJ-I]

Ans: Ethane, Propane

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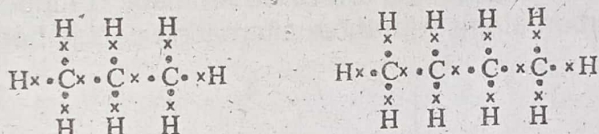
### 11.1

## Organic Compounds, Classification of Organic Compounds

14. What is Electronic or Dot and Cross formula?

(LHR-I/II,GUJ-I/II,FSD-I/II,MUL-I,SGD-II,DGK-I,SWL-I)

Ans: A formula that shows all the shared as well as the unshared electrons by dot (.) or cross (x) is called an electronic formula.

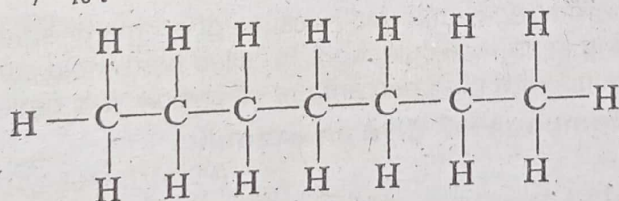


15. Give the condensed and structural formulas of  $\text{C}_7\text{H}_{16}$ .

(LHR-II,GUJ-I/II,FSD-I,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

Ans. Condensed formulae of  $\text{C}_7\text{H}_{16}$  :  $\text{H}_3\text{C}(\text{CH}_2)_5\text{CH}_3$

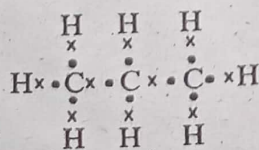
Structural formulas of  $\text{C}_7\text{H}_{16}$  :



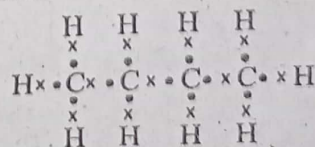
16. Write down the Dot and Cross Formula of Propane and n-Butane.

(LHR-I/II,MUL-I,SGD-I,DGK-I/II,SWL-I/II)

Ans.



propane



n-Butane

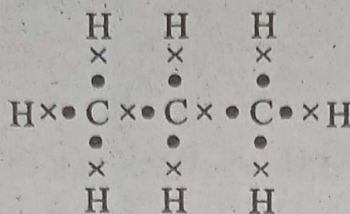
17. Define Dot and Cross Formula. Also write Dot and Cross Formula of Propane.

(LHR-I/II,FSD-I,DGK-I,SWL-I,MUL-II)

Ans. A formula that shows all the shared as well as the unshared electrons by dot (.) or cross (x)



is called an electronic formula.



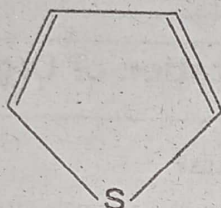
propane

18. What are heterocyclic compounds? Give two examples.

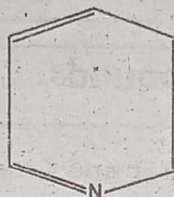
(LHR-GII,SGD-GI,II,DGK-GII,MTN-GI,II)

Ans: Cyclic compounds that contain one or more atoms other than that of carbon atoms in their rings are called heterocyclic compounds.

Example:



Thiophene

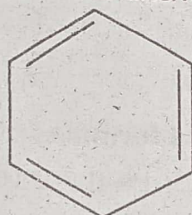


Pyridine

19. Why benzene is called aromatic compound.

(GUJ-I,FSD-I,DGK-I,SWL-I,MUL-II)

Ans: Benzene is called aromatic compound because of aroma or smell it has. Organic compounds that contain at least one benzene ring are called aromatic compounds. In addition, benzene ring is made up of six carbon atoms with three alternating double bonds.



benzene

20. Write down two Properties of Naphthalene. (GUJ-I/II,,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

Ans: Properties of Naphthalene:

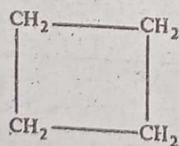
- Naphthalene is called aromatic compound because of aroma or smell it has.
- It contains benzene ring in its molecule, so it is called benzenoid compound.
- As it is organic compound with high percentage of carbon, it is generally combustible.

21. What are Alicyclic compounds? Give an example.

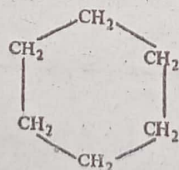
(FSD-I/II,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

Ans: Alicyclic compounds: Carbocyclic compounds which do not have benzene ring in their molecules are called alicyclic or non-benzenoid compounds.

Examples:



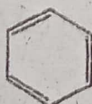
Cyclobutane



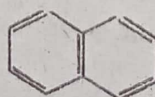
Cyclohexane

22. Write any two names of aromatic compounds. (LHR-I/II,MUL-I,SGD-I,DGK-I/II,SWL-I/II)

Ans.



Benzene



Naphthalene



11.2

## Sources of Organic Compounds

11.3

## Uses of Organic Compounds

11.4

## Alkanes and Alkyl Radicals

11.5

## Functional Groups

11.6

## Functional Groups Test

23. Write short note on coke.

[LHR-II, GUJ-I, FSD-II, DGK-I, SWL-VII]

Ans. Coke is 98% carbon. It is left behind residue of coal. When coal is subjected to destructive distillation, it loses all its volatile components and leaves behind a solid residue called coke. It is mainly used as a reducing agent in the extraction of metals especially iron. It is also used as fuel.

24. Write use of coal gas.

[FSD-II, DGK-I, SWL-VII]

Ans. Coal gas is mainly used as fuel in industries.

25. What is meant by destructive distillation?

[DGK-II, MTN-I, SGD-I/II, BWP-I]

Ans. The strong heating of coal in the absence of air is called destructive distillation.

26. How coal is formed?

[BWP-II, MTN-I, SWL-II, DGK-I]

Ans. Coal is formed by the decomposition of dead plants buried under the Earth's crust millions of years ago. Conversion of wood into coal is called carbonization. It is very slow bio-chemical process. It takes place in the absence of air under high pressure and high temperature over a long period of time (about 500 millions of years). Wood contains about 40% carbon so depending upon the extent of carbonization process, four types of coal are formed.

27. Write down two uses of organic compounds.

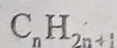
[DGK-I, MTN-II, GUJ-I/II]

Ans. i. **Uses as Clothing:** All types of clothing (we wear, we use as bed sheets etc.) are made up of natural fibres (cotton, silk and wool, etc.) and synthetic fibres (nylon, Dacron and acrylic etc.) all these are organic compounds.

ii. The fuel we use for automobiles and domestic purposes are coal, petroleum and natural gas these are called fossil fuels. All of these are organic compounds.

28. How are alkyl radicals formed? Explain with an example. (SGD-GI, FSD-GI, LHR-GII)

Ans: **Formation of Alkyl Radicals:** Alkyl radicals are derivatives of alkanes. They are formed by the removal of one of the hydrogen atoms of an alkane and are represented by a letter 'R'. Their name is written by replacing "ane" of alkane with 'yl' Their general formula is



Example: Molecular formula of methane is  $CH_4$ . Its alkyl radical is  $CH_3$  - (methyl).

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

29. Write the formulae of:

(i) Acetylene (ii) Ethyl Alcohol

Ans: (i) Acetylene  $C_2H_2$ (ii) Ethyl Alcohol  $C_2H_5OH$ 

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

30. What is ether linkage?

Ans: **Ether Linkage:**

The functional group of ether is C - O - C. Their general formula is R - O - R'. Where R and R' are alkyl groups.

Examples: Dimethyl ether:  $(CH_3 - O - CH_3)$  and

Ethyl methyl ether:  $(CH_3 - O - CH_2CH_3)$



31. Explain Carboxyl Group? Give one example. (GUJ-I/II,,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

Ans: Carboxyl Group: Compounds containing functional group  $\text{—}\overset{\text{O}}{\parallel}\text{C—OH}$  are called carboxylic

acids. Their general formula is  $\text{R—}\overset{\text{O}}{\parallel}\text{C—OH}$

Example:  $\text{H—}\overset{\text{O}}{\parallel}\text{C—OH}$   
Formic acid

32. Write formula of methyl acetate and Ethyl acetate.

(FSD-I/II,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

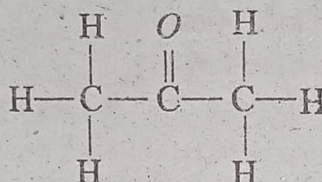
Ans:  $\text{H}_3\text{C—}\overset{\text{O}}{\parallel}\text{C—O—CH}_3$   
Methyl acetate

$\text{H}_3\text{C—}\overset{\text{O}}{\parallel}\text{C—O—C}_2\text{H}_5$   
Ethyl acetate

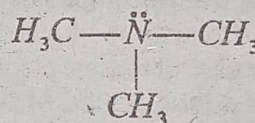
33. Write down the structural formulae of acetone and trimethylamine.

(GUJ-I/II,,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

Ans. structural formulae of acetone:



structural formulae of trimethylamine:



34. Write a test for unsaturation of organic compounds. [LHR-II,FSD-II,RWP-II,RUJ-II,SWL-I]

Ans: Bromine water test: Use the given organic compound in small quantity upto  $2.0\text{cm}^3$  and dissolve in carbon tetrachloride ( $\text{CCl}_4$ ). Add to  $2\text{cm}^3$  of bromine water and shake it well.

Result: The colour of the bromine will vanish (disappear).

## Solved Exercise

### Multiple Choice Questions

- The ability of carbon atoms to form chains is called:  
(a) isomerism (b) catenation (c) resonance (d) condensation.
- Coal having 90% carbon contents is called:  
(a) peat (b) lignite (c) anthracite (d) bituminous
- Main component of natural gas is:  
(a) methane (b) propane (c) butane (d) propane
- The strong heating of coal in retorts in the absence of air is called:  
(a) Fractional distillation (b) sublimation  
(c) roasting (d) destructive distillation
- Pitch is black residue of:  
(a) Coke (b) Coal-tar (c) carbon black (d) coal gas
- Natural gas is 85% methane. It is used to make the following except:  
(a) carbon black (b) coke (c) coal tar (d) coal gas
- Which one of the following does not contain starch?  
(a) sugar cane (b) maize (c) barley (d) potatoes
- Petroleum is refined by:  
(a) destructive distillation (b) fractional distillation  
(c) simple distillation (d) dry distillation



9. In laboratory urea was prepared by:  
(a) Wholer (b) Rutherford (c) Berzellius (d) Dalton
10. General formula of alkyl radical is: (GUJ-I, DGK-I, MLT-I, SRG-II)(ALP)  
(a)  $C_nH_{2n+2}$  (b)  $C_nH_{2n-2}$  (c)  $C_nH_{2n+1}$  (d)  $C_nH_{2n}$
11. Identify which one of the following compounds is a ketone: (MLT-II)(ALP)  
(a)  $(CH_3)_2CHOH$  (b)  $(CH_3)_2CO$  (c)  $(CH_3)_2NH$  (d)  $(CH_3)_2CHCl$
12. The functional group-COOH is found in: (DGK-II, FSD-I, LHR-I)(ALP)  
(a) carboxylic acid (b) aldehydes (c) alcohols (d) ester
13. Which one of the following statements is not true about fossil fuels?  
(a) they all contain carbon (b) they are renewable  
(c) they produce pollutants when (d) they cause acid rain
14. Which one of the following is the hardest coal?  
(a) peat (b) lignite (c) bituminous (d) anthracite
15. In which of the following groups, oxygen is attached on both sides with carbon atoms? (RWP-I)(ALP)  
(a) ketone (b) ether (c) aldehyde (d) ester
16. Carbonization process is the conversion of:  
(a) coal into coal gas (b) coal into wood  
(c) Wood into coal (d) wood into coal tar
17. Coal gas is a mixture of:  
(a) CO and  $CH_4$  (b) CO,  $CH_4$ ,  $CO_2$   
(c) CO,  $CH_4$ ,  $CH_2$  (d) CO,  $H_2$  and  $CO_2$
18. Which one of the following is a synthetic fiber?  
(a) cotton (b) wool (c) nylon (d) petroleum
19. Which one of the following does not contain protein.  
(a) coal (b) natural gas (c) biogas (d) petroleum
20. Which one of the following does not contain protein.  
(a) pulse (b) potatoes (c) beans (d) eggs
21. Conversion of dead plant into coal by the action of bacteria and heat is called:  
(a) carbonization (b) catenation (c) hydrogenation (d) cracking
22. Which one of the following compounds is an aldehyde? (RWP-II, SWL-I)(ALP)  
(a)  $CH_3-CH_2-OH$  (b)  $CH_3-COOH$  (c)  $CH_3CHO$  (d)  $CH_3COCH_3$
23. Formula of acetaldehyde is:  
(a)  $CH_3-CH_2OH$  (b)  $CH_3-\overset{\overset{O}{\parallel}}{C}-OH-OH$  (c)  $CH_3-\overset{\overset{O}{\parallel}}{C}-H$  (d)  $H-\overset{\overset{O}{\parallel}}{C}-H$

### Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | b | 2  | c | 3  | a | 4  | d | 5  | B |
| 6  | c | 7  | a | 8  | b | 9  | a | 10 | C |
| 11 | b | 12 | a | 13 | b | 14 | d | 15 | B |
| 16 | c | 17 | c | 18 | c | 19 | c | 20 | B |
| 21 | a | 22 | c | 23 | c |    |   |    |   |

### Short Questions

1. What is meant by the term catenation? Give an example of a compound that displays catenation?

Ans. The ability of carbon atoms to link with other carbon atoms to form chains and large rings is called catenation. Carbon is a compound which displays catenation.

#### Basic conditions for catenation:

Two basic conditions for an element to exhibit catenation are:

- (a) Element should have valency two or greater than two.



- (b) Bonds made by an element with its own atoms should be stronger than the bonds made by the element with other atoms especially oxygen.

**2. How coal is formed?**

**Ans.** Coal is formed by the decomposition of dead plants buried under the Earth's crust millions of years ago. Conversion of wood into coal is called carbonization. It is very slow bio-chemical process. It takes place in the absence of air under high pressure and high temperature over a long period of time (about 500 millions of years).

**3. What is importance of natural gas?**

- Ans.** i) Natural gas is used as fuel in homes as well as in industries.  
 ii) It is used as fuel in automobiles as compressed natural gas (CNG).  
 iii) Natural gas is also used to make carbon black and fertilizer.

**4. Justify that organic compounds are used as food.**

**Ans.** Organic compounds include carbohydrates, proteins, lipids, enzymes, vitamins, these are the components which we take in the form of food to get energy to perform different activities. Organic compounds are prepared naturally by animals and plants.

**5. How alkyl radicals are formed? Explain with examples.**

**Ans: Formation of Alkyl Radicals:**

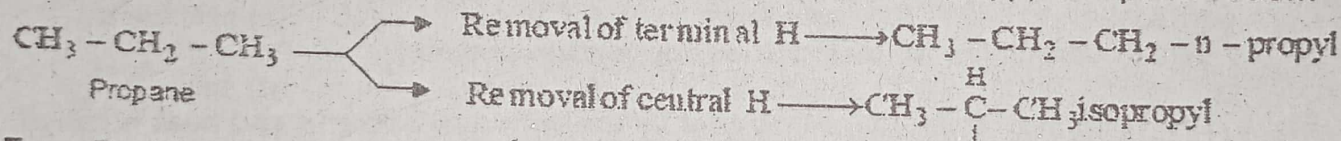
Alkyl radicals are derivatives of alkanes. They are formed by the removal of one of the hydrogen atoms of an alkane and are represented by a letter 'R'. Their name is written by replacing "ane" of alkane with 'yl'. Their general formula is  $C_nH_{2n+1}$ .

**Example:** Molecular formula of methane is  $CH_4$ . Its alkyl radical is  $CH_3 -$  (methyl).

**6. What is the difference between n-propyl and isopropyl? Explain with structure.**

(DGK-I)(ALP)

**Ans.** Propane has a straight chain structure. When terminal H is removed, it is called n-propyl. When hydrogen from central carbon is removed, it is called isopropyl, as explained below:

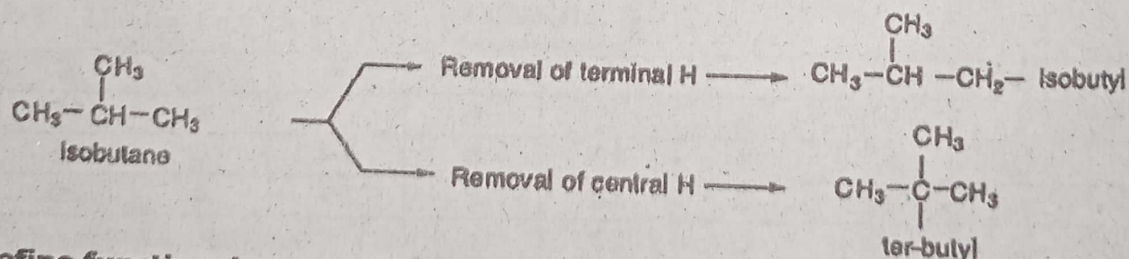
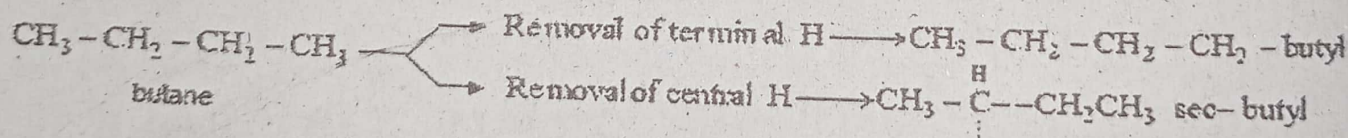


**7. Explain different radicals of butane'**

(GUJ-I,MLT-II)(ALP)

**Ans. Radicals of butane are given as:**

The radicals of butanes are formed as:



**8. Define functional group with an example.**

**Ans. Functional groups:**

(DGK-I)(ALP)

An atom or group of atoms or presence of double or triple bond which determines the characteristic properties of an organic compound is known as the functional group. Functional group of alcohol is  $OH^-$ .

**9. What is an ester group? Write down the formula of ethyl acetate.**

(SWL-I)(ALP)

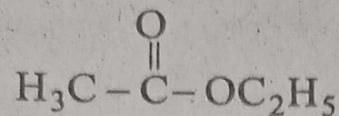
**Ans.** Organic compounds consisting  $RCOOR'$  functional group are called esters.



Their general formula is 
$$\text{R} - \overset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{OR}'$$

Where R and R' are alkyl groups. They may be same or different.

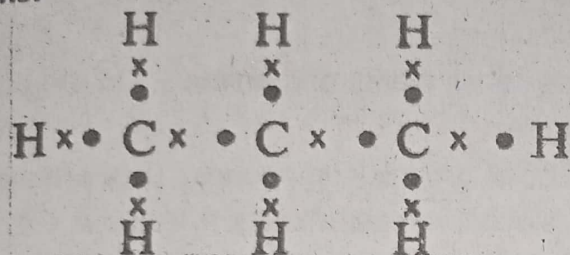
**Formula of ethyl acetate:**



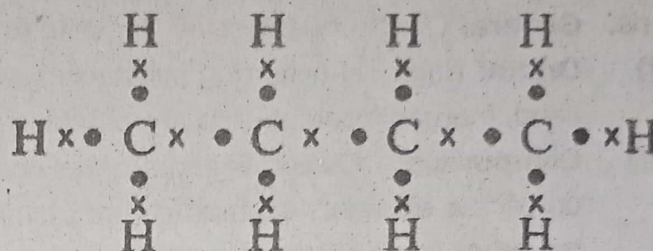
Ethyl acetate

10. Write down the dot and cross formula of propane and n-butane?

Ans.



Propane



n-butane

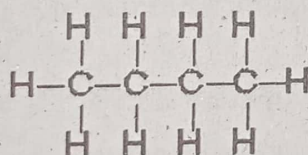
11: Define structural formula. Draw the structural formula of n-butane and isobutene. (FSD-I)(ALP)

Ans. **Structural Formula:** Formula which represents the exact arrangement of different atoms of various elements present in a molecule of a substance is called structural Formula.

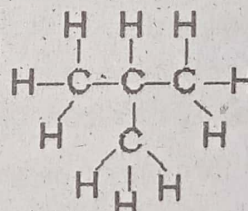
In a structural formula, single bond is represented by a single line (-), a double bond by two lines (=) and a triple bond by three lines (≡) between the bonded atoms.

Organic compounds may have same molecular formulae but different structural formula, e.g.

**Structural formula of butane  $\text{C}_4\text{H}_{10}$  are:**



n-Butane



iso-butane

12. Write classification of coal.

Ans. Depending upon the carbonization process, four types of coal are found. These types differ with respect to carbon content, volatile matter and moisture.

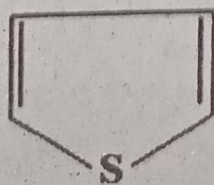
- i. **Peat:** It contains 60% of carbon contents. It is inferior quality coal used in kiln.
- ii. **Lignite:** It contains 70% of carbon contents. It is soft coal, used in thermal power station.
- iii. **Bituminous:** It contains 80% of carbon contents. It is common variety of coal used as house hold coal.
- iv. **Anthracite:** It contains 90% of carbon contents. It is superior quality hard coal that is used in industry.

13. What are heterocyclic compounds? Give two examples.

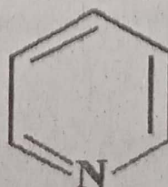
Ans. **Heterocyclic compounds:**

Cyclic compounds that contain one or more atoms other than that of carbon atoms in their rings are called heterocyclic compounds.

Examples:



Thiophene



Pyridine



**14. Why benzene and other homologous compounds of benzene are called aromatic compounds?**

**Ans.** As these organic compounds contain at least one benzene ring in their molecules, so these are called aromatic compounds. A benzene ring is made up of six carbon atoms with three alternating double bonds. Another reason for being aromatic is because of the aroma or smell they have.

**Example:** Benzene, Naphthalene

### Extensive Questions

**1. Write characteristics of organic compounds.**

**Ans. General Characteristics of Organic Compounds:**

- (i) **Origin:** Naturally occurring substances are obtained from plants and animals. On the other hand, inorganic compounds are obtained from minerals and rocks.
- (ii) **Composition:** Carbon is an essential constituent of all organic compounds. They are made up of few elements such as carbon, hydrogen, nitrogen, oxygen, halogen, sulphur etc. On the other hand, inorganic compounds are made up of almost all the elements of the periodic table known so far.
- (iii) **Covalent linkage:** Organic compounds contain covalent bonds, that may be polar or non-polar, while the inorganic compounds mostly contain ionic bonds.
- (iv) **Solubility:** Organic compounds having non-polar linkages are generally soluble in organic solvents like alcohol, ether, benzene, carbon disulphide etc. On the other hand, the inorganic compounds with ionic bonds are soluble in polar solvents like water.

**2. Explain homologous series.**

[DGK-GII-21][BWP-GI-21](ALP)

**Ans: Homologous series:** Organic compounds are divided into groups of compounds having similar chemical properties. Each group is known as a homologous series.

**Characteristics of homologous series:**

- i. **General formula:** All members of a series can be represented by a general formula for example, general formula of alkanes, alkenes and alkynes are  $C_nH_{2n+2}$ ,  $C_nH_{2n}$  and  $C_nH_{2n-2}$  respectively.
- ii. They can be prepared by similar general methods.
- iii. They have similar chemical properties (because they contain the same functional group).
- iv. Successive members of the series differ by one unit of  $-CH_2-$  and 14 units in their relative molecular mass.
- v. There is a regular change in their physical properties; the melting and boiling points increase gradually with the increase of molecular masses.

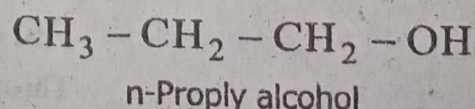
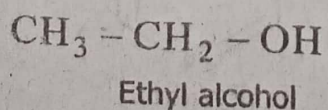
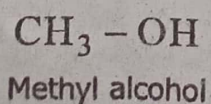
**3. Define functional group. Write a note on any four functional groups.**

[SWL-21][RWP-GII-21][DGK-GI-21][MTN-GI-21][GUJ-GI-21](ALP)

**Ans. Functional groups:** An atom or group of atoms or presence of double or triple bond which determines the characteristic properties of an organic compound is known as the functional group.

**(a) Alcoholic Group:** The functional group of alcohols is  $-OH$ . Their general formula is  $ROH$ . Where R is any alkyl group.

**Example:**





(b) **Ether Linkage:** The functional group of ether is C-O-C. Their general formula is  $R-O-R'$

Where R and  $R'$  are alkyl groups.

R and  $R'$  may be same or different.

**Examples:**

i.  $H_3C-O-CH_3$  Dimethyl ether

ii.  $C_2H_5-O-C_2H_5$  diethyl ether

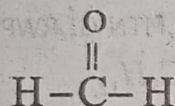
iii.  $H_3C-O-C_2H_5$  Ethyl methyl ether

**Aldehydic Group:**

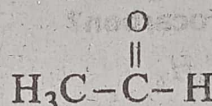
Aldehyde family consists of functional group  $\begin{array}{c} O \\ || \\ -C-H \end{array}$  Their general formula is  $RCHO$ .

Where R stands for H or some alkyl group.

**Examples:**



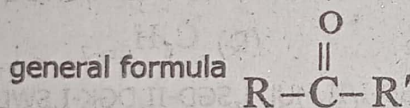
Formaldehyde



Acetaldehyde

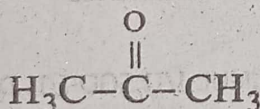
(iv) **Ketonic Group:**

Compounds containing the functional group  $\begin{array}{c} \diagup \\ C=O \\ \diagdown \end{array}$  are called ketones. They have the

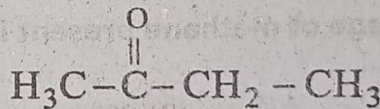


Where R and  $R'$  are alkyl groups. They may be same or different.

**Examples:**



Acetone (Dimethyl ketone)

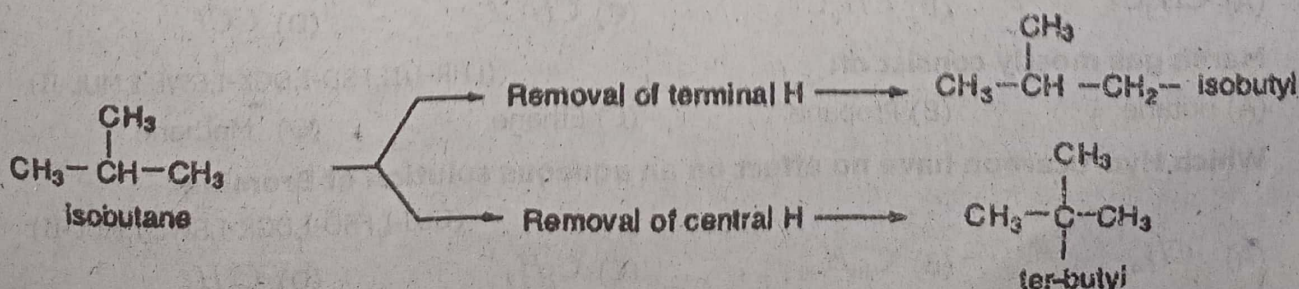
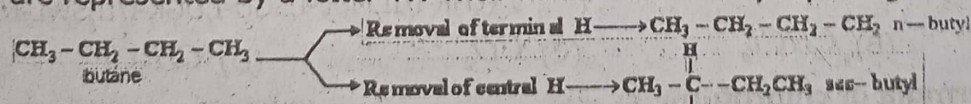


Ethyl methyl ketone

4. **How alkyl radicals are formed? Write alkyl radicals of Butane.** [MTN-GII-21](ALP)

**Ans: Formation of alkyl Radicals:**

Alkyl Radicals are formed by the removal of one of the hydrogen atom of an alkanes and are represented by a letter 'R'. Their name is written by replacing 'ane' of alkanes with 'yl'.





Chapter

12

Hydrocarbons

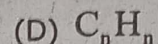
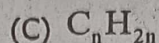
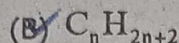
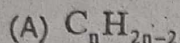
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## ALP Annual Paper 2021

## MCQ's

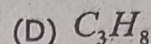
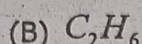
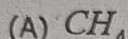
1. The general formula of saturated hydrocarbons is:

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)



2. Which one of the following is an unsaturated hydrocarbons:

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)



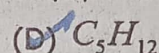
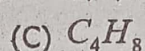
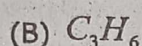
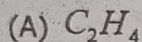
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## 12.1

## Alkanes

3. Which is a saturated hydrocarbon?

(GUJ-GI, II, SGD-GI, GII, FSD-GI, II, MTN-GI, RWP-GI)



4. Which one of the following compounds is a saturated hydrocarbon:

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

(A) Methane

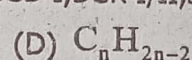
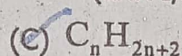
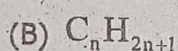
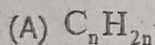
(B) Ethyne

(C) Propene

(D) Propyne

5. General formula of alkanes is:

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)



6. Which is a substitution reaction?

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

(A) Halogenation of alkynes

(B) Halogenation of alkenes

(C) Halogenation of alkanes

(D) Bromination of alkenes

7. Percentage of methane present in natural gas is:

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

(A) 75%

(B) 80%

(C) 85%

(D) 90%

8. Which reaction is the characteristic property of alkanes:

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

(A) Substitution reaction

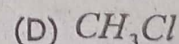
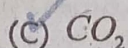
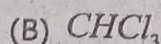
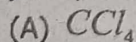
(B) Oxidation Reaction

(C) Reduction Reaction

(D) Addition Reaction

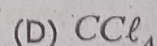
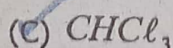
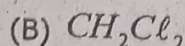
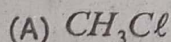
9. Which one of the following compounds is not produced by the halogenation of methane?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)



10. The chemical formula of chloroform is:

(RWP-GII, GUJ-GII, MTN-GI)



11. Marsh gas mostly consist of:

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

(A) butane

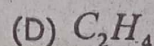
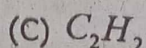
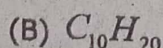
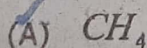
(B) Propane

(C) Ethane

(D) Methane

12. Which Hydrocarbon have no effect on an aqueous solution of Bromine:

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)





13. Alkanes are also known as: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) Halogens (B) Paraffins (C) Olefins (D) Acetylenes
14. Which one of following is called paraffins? (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A) alkanes (B) alkenes (C) alkynes (D) alcohol
15. Which is used as dry clenaing? (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $\text{CCl}_4$  (B)  $\text{CHCl}_3$  (C)  $\text{CH}_4$  (D)  $\text{CH}_2\text{Cl}_2$
16. Incomplete combustion of alkanes produces. (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A) Carbon dioxide only (B) Carbon monoxide only  
 (C) Carbon monoxide and carbon black (D) Carbon dioxide and carbon black
17. Molecular formula of butane is: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A)  $\text{C}_4\text{H}_8$  (B)  $\text{C}_4\text{H}_{10}$  (C)  $\text{C}_4\text{H}_{12}$  (D)  $\text{C}_4\text{H}_6$

## 12.2

## Alkenes

18. Which one is also called "Olefins"? (LHR-GI, GUJ-GI)  
 (A) alkanes (B) alkenes (C) alkynes (D) alcohols
19. Oxidation of alkenes produces: (GUJ-GI, SGD-GII, LHR-GII, FSD-GI, BWP-GI)  
 (A) Glyoxal (B) Oxalic acid (C) Formic acid (D) Glycol
20. The order of reactivity of hydrogen halides with alkenes is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $\text{HI} > \text{HBr}$  (B)  $\text{HBr} > \text{HI}$  (C)  $\text{HCl} > \text{HBr}$  (D)  $\text{HBr} < \text{HCl}$
21. Alkenes are also known as: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A) methane (B) paraffins (C) olefins (D) acetylenes
22. Catalyst used for hydrogenation of vegetable oil is: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) Al (B) Ni (C) Co (D) Pt

## 12.3

## Alkynes

23. Benzene is formed by the polymerization of: (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) Methane (B) Acetylene (C) Ethene (D) Butene
24. General formula of alkynes is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $\text{C}_n\text{H}_{2n-2}$  (B)  $\text{C}_n\text{H}_{2n+2}$  (C)  $\text{C}_n\text{H}_{2n+1}$  (D)  $\text{C}_n\text{H}_{2n}$
25. Alkynes are also called: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A) Olefines (B) Ethene (C) Paraffins (D) Acetylenes
26. The End Product of Oxidation of Acetylene is: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A) Oxalic Acid (B) Glycol (C) Glyoxal (D) Potassium Hydroxide
27. About \_\_\_\_\_ % traces of acetylene are present in coal gas. (SGD-I/II, DGK-II, SWL-II)  
 (A) 0.06 (B) 0.07 (C) 0.08 (D) 0.09



## Answers

|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | B | 2  | C | 3  | D | 4  | A | 5  | C | 6  | C | 7  | C | 8  | A | 9  | C | 10 | C |
| 11 | D | 12 | A | 13 | B | 14 | A | 15 | A | 16 | C | 17 | B | 18 | B | 19 | D | 20 | A |
| 21 | C | 22 | B | 23 | B | 24 | A | 25 | D | 26 | A | 27 | A |    |   |    |   |    |   |

## ALP Annual Paper 2021

## Short Questions

1. Why are the alkanes called paraffins? (GUJ-GII, SWL-GGII, DGK-GI, FSD-GI, BWP-GI, II)

Ans: In alkanes, all the bonds of carbon atoms are single that means valencies of carbon atoms are fully satisfied (saturated). Therefore they are least reactive. That is the reason, alkanes are called paraffins (para means less, and affins means affinity or reactivity).

2. Write down two uses of ethane. (LHR-GI)(RWP-GII)(DGK-GII, SWL-GII)

Ans: Uses of ethane:

- Natural gas is mixture of methane and ethane. It is used as domestic fuel.
- Compressed natural gas (CNG) is used as automobile fuel.
- It is used for manufacturing carbon black, methyl alcohol, chloroform, carbon tetrachloride, formaldehyde and acetaldehyde.

3. Write two uses of ethene. (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Uses of Ethene (Ethylene): (i) Ethene is used for artificial ripening of fruits.  
(ii) Ethene is used as a general anaesthetic

4. How Halogenation take place in Alkenes? Give its chemical equation.

(MTN-GII, DGK-GI)

Ans: Halogenation of alkenes is carried out by the addition of halogen like chlorine or bromine. Bromination of alkenes is very important reaction. When bromine water (a solution of bromine in water having red-brown colour) is added to ethane in an inert solvent like carbon tetrachloride its colour is discharged at once.

Equation:  $\text{H}_2\text{C} = \text{CH}_2 + \text{Br}_2 \longrightarrow \text{Br} - \text{CH}_2 - \text{CH}_2 - \text{Br}$

5. Which reaction is used to identify the unsaturation of an organic compound?

(SGD-I/II, DGK-II, SWL-II)

Ans: When bromine water (a solution of bromine in water having red-brown colour) is added to ethane in an inert solvent like carbon tetrachloride, its colour is discharged at once but ethane does not react with bromine water.

Equation:  $\text{H}_2\text{C} = \text{CH}_2 + \text{Br}_2 \xrightarrow{\text{CCl}_4} \text{Br} - \text{CH}_2 - \text{CH}_2 - \text{Br}$

$\text{H}_3\text{C} - \text{CH}_3 + \text{Br}_2 \longrightarrow \text{No Reaction}$

In the reaction double bond of ethene is converted into a single bond by the addition of a molecule of bromine. This reaction is used to identify the unsaturation of an organic compound.

6. Why alkenes are reactive? (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans. Alkenes are reactive compounds because the electrons of the double bond are easily available for reaction. These compounds have the tendency to react readily by adding other atoms, to become saturated compounds. As a result, the double bond is converted into a single bond that is more stable.



## 7. Write two physical properties of alkynes.

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: i. Alkynes are insoluble in water but soluble in non polar solvents like Benzene, alcohol.

ii. Alkynes are also flammable. They produce smokier flames than those of alkanes and alkenes.

## 8. Write the general formulae of alkenes and alkynes.

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans. Alkenes general formula  $C_nH_{2n+2}$  and Alkynes general formula  $C_nH_{2n-2}$ .

## 9. Why the Alkynes are called Acetylene?

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II, LHR-I)

Ans: Alkynes are also called acetylenes because of the name of the first member of this series is acetylene.

## 10. Define hydrocarbons. Give an example.

(DGK-I)

Ans: The compounds which are made up of only carbon and hydrogen are called hydrocarbons.

Example: Butane

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## 12.1

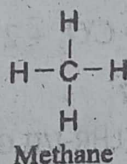
## Alkanes

## 11. What are saturated hydrocarbons. Give example.

(LHR-GI, RWP-GI, II, BWP-GI)

Ans: **Saturated Hydrocarbons:** The hydrocarbons in which all the four valencies of carbon atoms are fully satisfied (saturated) by single bonds with other carbon atoms and hydrogen atoms are called saturated hydrocarbons.

Example.



## 12. Differentiate between Saturated and Unsaturated Hydrocarbons.

(MTN-GI, RWP-GI, LHR-GII, GUJ-GII, MTN-GI)

Ans:

| Saturated Hydrocarbon  | Unsaturated Hydrocarbon   |
|--|---|
| (i) The hydrocarbons in which all the four valencies of carbon atoms are fully satisfied by single bonds with other carbon atoms and hydrogen atoms are called saturated hydrocarbons. | (i) The hydrocarbons in which two carbon atoms are linked by a double or a triple bond are called unsaturated hydrocarbons. |
| (ii) These are called alkanes with general formula $C_nH_{2n+2}$   | (ii) These are called alkenes and alkynes having general formula $C_nH_{2n}$ and $C_nH_{2n-2}$ respectively.                |
| (iii) Example: $CH_4$  | (iii) Examples: $C_2H_4$ , $C_2H_2$   |

## 13. Why are hydrocarbons considered as parent organic compounds?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: **Hydrocarbons considered as parent organic compounds:-**

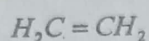
Hydrocarbons are considered as parent organic compounds since other organic compounds are considered to be derived from them by the replacement of one or more hydrogen atoms by other atoms or group of atoms.



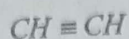
14. Write down the name of any two unsaturated hydrocarbons.

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans:



Ethene



Ethyne

15. Write condensed and dot and cross formula of ethyne.

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans. Condense formula of ethyne is  $HC \equiv CH$ .

Dot and cross formula of ethyne is  $H \times \cdot C \times \cdot \cdot \cdot C \cdot \times H$ .

16. Define Unsaturated Hydrocarbons with general formula.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: **Unsaturated Hydrocarbon:** The hydrocarbons in which two carbon atoms are linked by a double or a triple bond are called unsaturated hydrocarbons.

These are called alkenes and alkynes.

General formula of alkene:  $C_n H_{2n}$

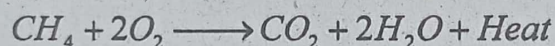
General formula of alkyne:  $C_n H_{2n-2}$

17. What is meant by combustion?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: **Combustion Process:**

Alkanes burn in the presence of excess of air or oxygen to produce a lot of heat, carbon dioxide and water. This reaction takes place in automobile combustion engines, domestic heaters and cooking appliances.

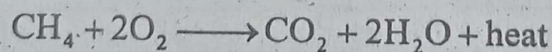


18. How Hydrocarbons are used as fuel?

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans: **Hydrocarbons Act as Fuel:**

Hydrocarbon burn in the excess of air or oxygen to produce a lot of heat, carbon dioxide and water. So hydrocarbons are used as fuels. It is highly exothermic reaction and because of it alkanes are used as fuel.

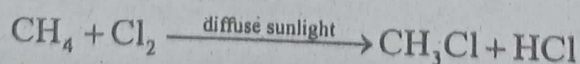


19. What do you know about halogenation of Alkanes?

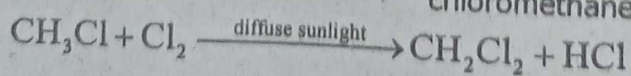
(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: **Halogenation reaction:** "A reaction in which one or more hydrogen atoms of a saturated compound are replaced with some other atoms (like halogen) is called a substitution reaction." or halogenation.

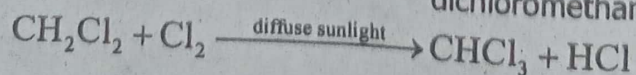
Equation:



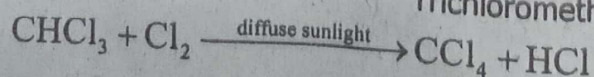
chloromethane



dichloromethane



Trichloromethane



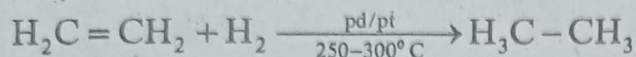
Tetrachloromethane



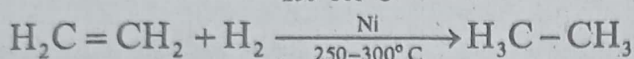
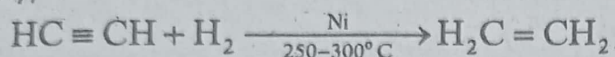
20. Define the process of hydrogenation. Give example.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans:** Hydrogenation means addition of molecular hydrogen in alkenes and alkynes. Alkenes and alkynes are unsaturated compounds, so they have the capacity to add up atoms in them. This reaction is carried out in the presence of nickel catalyst at 250°C to 300°C. However, in the presence of catalyst platinum or palladium, the reaction takes place at room temperature, such as:



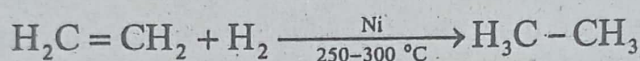
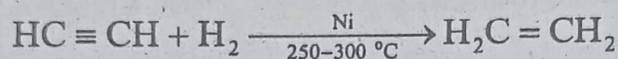
Similarly,



21. Complete and balance the given reaction:  $\text{HC}\equiv\text{CH} + \text{H}_2 \xrightarrow{?} ?$

(SGD-I/II, DGK-II, SWL-II)

**Ans.**



22. Write down two uses of methane.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans. Uses of Methane:** (i) Natural gas that is chiefly methane, is used as domestic fuel.  
(ii) Compressed natural gas (CNG) is used as automobile fuel.

## 12.2

### Alkenes

23. State one important use of each:

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

(a) Chloroform

(b) Carbon tetra chloride.

**Ans:** a) **Use of chloroform:** Chloroform is used as a solvent for rubber, waxes etc and for anaesthesia.

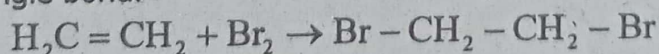
b) **Use of carbon tetrachloride:**

Carbon tetrachloride is used as an industrial solvent and dry cleaner.

24. Why colour of bromine water discharges on addition of ethene in it?

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** Colour of bromine water discharges on addition of ethene because double bond of ethene is converted into a single bond.



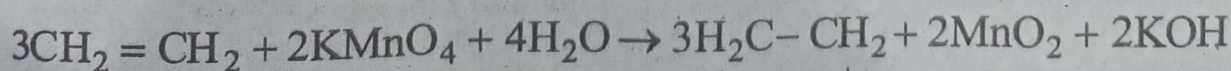
This reaction is used to identify the unsaturation of an organic compound.

25. How can you identify ethane from ethene?

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans:** Ethene decolorize the pink colour of acidified dilute solution of potassium permanganate because the double bond electrons react with  $\text{MnO}_4^-$  ion, which further goes on reaction to form  $\text{MnO}_4^-$  and colorless ethane glycol (1,2 - ethanediol). Such as, there is addition of two 'hydroxyl group' at the double bond.

**Equation:**



Ethene

OH OH

1,2 - Ethanediol

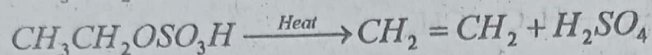
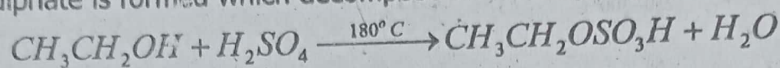


While ethane does not decolorize the pink colour of  $\text{KMnO}_4$  as it is saturated one. In this way, we can identify ethene from ethane.

26. What happens when ethyl alcohol is heated in the presence of  $\text{H}_2\text{SO}_4$ ?

(SGD-I/II, DGK-II, SWL-II)

Ans: **Dehydration of Alcohols:** Dehydration is removal of water. Ethene is prepared by heating a mixture of ethanol and excess of concentrated  $\text{H}_2\text{SO}_4$  at  $180^\circ\text{C}$ . In first step ethyl hydrogen sulphate is formed which decompose on heating to produce ethane.



27. Describe two physical properties of alkenes.

(DGK-GI, DGK-GII, SWL-GII)

Ans: **Physical properties of alkenes:**

- (i) The first member of the alkenes is ethene. It is a colourless gas with pleasant odour.
- (ii) Alkenes are non-polar, therefore, they are insoluble in water but soluble in organic solvents.

28. Describe two occurrence of Alkenes.

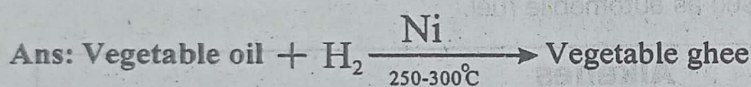
(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: **Occurance of Alkenes:**

- (i) Alkenes being more reactive than alkanes, seldom occur free in nature.
- (ii) Lower alkenes occur in coal gas in minute quantities.

29. Write an equation to change oil into ghee.

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)



## 12.3

## Alkynes

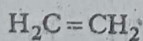
30. What is the difference between alkenes and alkynes?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: **Alkenes:** (i) The compounds in which two carbon atoms are linked by a double covalent bond are called alkenes.

(ii) **General formula:** They have general formula  $\text{C}_n\text{H}_{2n}$  and functional group  $> \text{C} = \text{C} <$ .

(iii) **Examples:** For example, ethene and propene.



Ethene



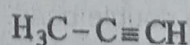
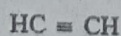
Propene

**Alkynes:** The hydrocarbons in which the two carbon atoms are linked by a triple covalent bond are called alkynes.

(ii) **General formula:**

They have general formula  $\text{C}_n\text{H}_{2n-2}$  and functional group  $-\text{C} \equiv \text{C}-$ .

(iii) **Examples:** For example, ethyne and propyne.



31. Write down the Molecular and Structural formula of Ethyne.

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans: Molecular formula of Ethyne  $\text{C}_2\text{H}_2$

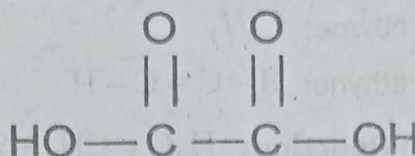
Structural formula of Ethyne:  $\text{H} - \text{C} \equiv \text{C} - \text{H}$



32. What is the formula of Oxalic Acid?

BWP-GII,SGD-GI

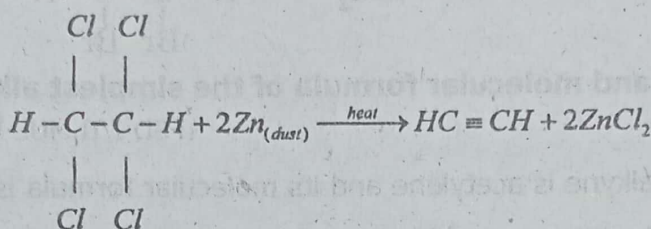
Ans: Formula of Oxalic acid is



33. Prepare acetylene from tetrachloroethane. (FSD-I/II,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

Ans: Preparation of acetylene by tetra-chloroethane:

When alkyl tetra-chloroethane is heated with Zinc dust, the elimination of halogen atoms takes place to form acetylene.



34. Write down two uses of Acetylene.

(MTN-GII,DGK-GI,GUJ-GII)

Ans: Uses of Acetylene: (i) Acetylene produces oxyacetylene flame with oxygen. It is highly exothermic reaction. Heat released is used for welding purposes:

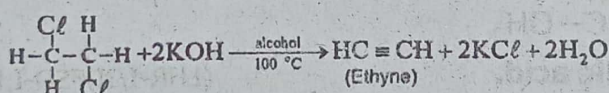
(ii) It is used for ripening of fruits.

35. Give the preparation of Alkynes by Dehydrohalogenation of vicinal dihalides.

(LHR-I/II,FSD-I,DGK-I,SWL-I,MUL-II)

Ans: Dehydrohalogenation of vicinal dihalides:

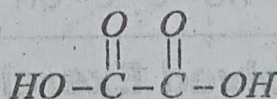
When a vicinal dihalide is heated with alcoholic KOH, two hydrogen atoms along with two halogen atoms are removed two adjacent carbon atoms with the formation of a triple bond between the adjacent carbons.



36. Write down the formulae of oxalic acid and carbon tetrachloride.

(GUJ-I/II,,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

Ans. Formula of oxalic acid:

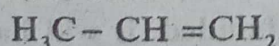


Formula of carbon tetrachloride:  $\text{CCl}_4$

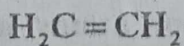
37. Which functional groups are present in alkenes and alkynes?

(SGD-I/II,DGK-II,SWL-II)

Ans. (a) alkenes: The compounds in which two carbon atoms are linked by a double bond are called alkenes. For example, ethene and propene.



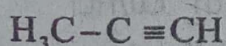
(Propene)



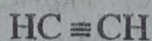
(Ethene)

These compounds have general formula  $\text{C}_n\text{H}_{2n}$  and functional group  $\text{>C=C<}$

(b) Alkynes: The hydrocarbons in which two carbon atoms are linked by a triple bond are called alkynes. For example, ethyne and propyne.



(Propyne)



(Ethyne)

They have general formula  $\text{C}_n\text{H}_{2n-2}$  and functional group  $-\text{C} \equiv \text{C}-$ .



38. Write the molecular and structural formula for Ethyne.

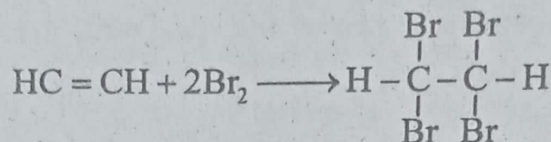
Ans: Molecular formula for ethyne:  $C_2H_2$

Structural formula for ethyne:  $H-C \equiv C-H$

39. Complete the given Reaction:  $H_2C=CH_2 + 2Br_2 \longrightarrow ?$

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans.



40. Write the name and molecular formula of the simplest alkyne.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Name of simplest alkyne is acetylene and its molecular formula is  $C_2H_2$ .

41. Write one use of each of acetylene and chloroform.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Use of chloroform: It is used as a solvent for rubber, waxes, etc., and for anaesthesia.

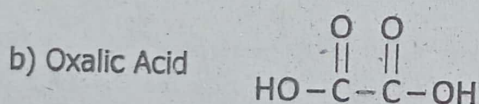
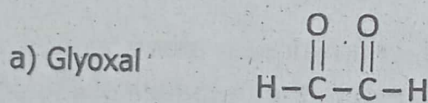
Use of Acetylene: It is used for welding.

42. Write the structural formulae of the following. (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

(a) Glyoxal

(b) Oxalic acid

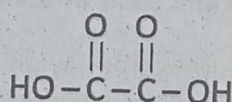
Ans: Structural formula of



43. Write the formula of oxalic acid.

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: Formula of Oxalic Acid:



## Solved Exercise

### Multiple Choice Questions

- Which one of these hydrocarbon molecules would have no effect on an aqueous solution of bromine? (MLT-I)(ALP)  
 (a)  $CH_4$  (b)  $C_{10}H_{20}$  (c)  $C_2H_4$  (d)  $C_2H_2$
- If an organic compound has 4 carbon atoms, all singly bonded, it will have the following characteristics except one.  
 (a) It will be saturated hydrocarbon (b) Its name will be n-butane.  
 (c) It will have 8 hydrogen atoms (d) It will be least reactive
- The reduction of alkyl halides takes place in the presence of. (DGK-II, MLT-I, LHR-I)(ALP)  
 (a)  $Zn/HCl$  (b)  $Na/HCl$  (c)  $Mg/HCl$  (d)  $Cu/HCl$
- Halogenation of methane does not produce which one of the following: (SWL-I)(ALP)  
 (a) Carbon tetrachloride (b) Chloroform  
 (c) Carbon black (d) Chloromethane



5. **Incomplete combustion of alkanes produces:**
  - (a) Carbon dioxide only
  - (b) Carbon monoxide only
  - (c) Carbon monoxide and carbon black
  - (d) Carbon dioxide and carbon black
6. **Alkenes are prepared from a alcohols by a process called.** (MLT-II,FSD-I,LHR-I)(ALP)
  - (a) Dehydrogenation
  - (b) Dehalogenation
  - (c) Dehydration
  - (d) Dehydrohalogenation
7. **Dehydrohalogenation takes place in the presence of:** (DGK-I,MLT-II)(ALP)
  - (a) NaOH.aqueous
  - (b) Alcoholic KOH
  - (c) Aqueous KOH
  - (d) Alcoholic NaOH
8. **Oxidation of ethane with  $\text{KMnO}_4$  produces.** (DGK-II,BWP-I)(ALP)
  - (a) Oxalic acid
  - (b) Glyoxal
  - (c) Ethane glycol
  - (d) Propene glycol
9. **Which one of these is a saturated hydrocarbon?**
  - (a)  $\text{C}_2\text{H}_4$
  - (b)  $\text{C}_3\text{H}_6$
  - (c)  $\text{C}_4\text{H}_8$
  - (d)  $\text{C}_5\text{H}_{12}$
10. **A hydrocarbon has molecular formula  $\text{C}_8\text{H}_{14}$ . What is the molecular formula of the next member of the same homologous series?**
  - (a)  $\text{C}_9\text{H}_{18}$
  - (b)  $\text{C}_9\text{H}_{16}$
  - (c)  $\text{C}_9\text{H}_{20}$
  - (d)  $\text{C}_9\text{H}_{12}$
11. **The molecular formulae of the first three members of the alkanes hydrocarbons are  $\text{CH}_4$ , and  $\text{C}_3\text{H}_8$ . What is the molecular formula for eight alkane member, octane, which is found in petrol?**
  - (a)  $\text{C}_8\text{H}_8$
  - (b)  $\text{C}_8\text{H}_{16}$
  - (c)  $\text{C}_8\text{H}_{18}$
  - (d)  $\text{C}_8\text{H}_{20}$
12. **One of the hydrocarbons reacts with one mole of hydrogen to form a saturated hydrocarbon. What formula could be of the X?** (SRG-II)(ALP)
  - (a)  $\text{C}_3\text{H}_8$
  - (b)  $\text{C}_6\text{H}_{12}$
  - (c)  $\text{C}_4\text{H}_{10}$
  - (d)  $\text{C}_7\text{H}_{16}$
13. **Dehydration of alcohols can be carried out with.** (SRG-II,GUJ-I)(ALP)
  - (a) NaOH
  - (b) KOH
  - (c)  $\text{H}_2\text{SO}_4$
  - (d) HCl
14. **The end product of oxidation of acetylene is:** (BWP-II,RWP-I,SWL-I,DGK-I,FSD-I)(ALP)
  - (a) Oxalic acid
  - (b) Glycol
  - (c) Glyoxal
  - (d) None of these
15. **Dehalogenation of tetrahalides produces acetylene. This reaction takes place in the presence of.**
  - (a) Sodium metal
  - (b) Zinc metal
  - (c) Magnesium metal
  - (d) Potassium metal
16. **Substitution reaction is the characteristic of:** (BWP-I/II,RWP-I/II)(ALP)
  - (a) Alkanes
  - (b) Alkenes
  - (c) Alkynes
  - (d) None of these
17. **Halogenation of methane in the presence of diffused sunlight takes place.**
  - (a) Suddenly, only in one step
  - (b) Slowly in one step
  - (c) In a series of four steps
  - (d) Fastly in two steps
18. **Which one of the followings is a substitution reaction?**
  - (a) Halogenations of alkynes
  - (b) Halogenations of alkenes
  - (c) Halogenations of alkanes
  - (d) Bromination of alkanes
19. **The order of reactivity of hydrogen halides with alkenes is:**
  - (a)  $\text{HI} > \text{HBr}$
  - (b)  $\text{HBr} > \text{HI}$
  - (c)  $\text{HCl} > \text{HBr}$
  - (d)  $\text{HBr} < \text{HCl}$



20. Oxidation of alkenes produces:

(a) Glyoxal

(b) Glycol

(c) Oxalic acid

(d) Formic acid

### Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | a | 2  | b | 3  | a | 4  | c | 5  | C |
| 6  | c | 7  | b | 8  | c | 9  | d | 10 | B |
| 11 | c | 12 | b | 13 | c | 14 | a | 15 | b |
| 16 | a | 17 | c | 18 | c | 19 | a | 20 | b |

### Short Questions

1. Differentiate between saturated and unsaturated hydrocarbons.

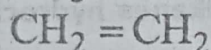
**Ans. Saturated hydrocarbons:** The hydrocarbons in which all the four valencies of carbon atoms are fully satisfied (saturated) by single bonds with other carbon atoms and hydrogen atoms is called saturated hydrocarbons.

Saturated hydrocarbons are also called alkane with general formula  $C_nH_{2n+2}$

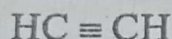
Example: Methane ( $CH_4$ ), ethane ( $C_2H_6$ ).

**Unsaturated hydrocarbons:** The hydrocarbons in which two carbon atoms are linked by a double or a triple bond are called unsaturated hydrocarbons.

Unsaturated hydrocarbons are also called alkene with general formula  $C_nH_{2n}$  and alkynes with general formula  $C_nH_{2n-2}$



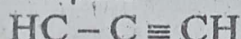
Ethene



Ethyne



Propene



Propyne

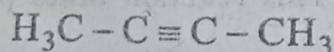
2. A compound consisting of four carbon atoms has a triple bond in it. How many hydrogen atoms are present in it?

**Ans.** As four carbon atoms and triple bond indicates that it is an alkyne and number of carbon atoms is four. The general formula of alkyne is.

So we get



$C_4H_6$  is butyne that has six number of hydrogen atoms in it with formula



3. Why the alkanes are called 'paraffins'?

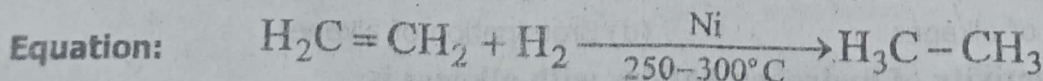
**Ans.** The simplest hydrocarbons are alkanes. In these compounds, all the bonds of carbon atoms are single it means carbon atoms are saturated. Therefore, they are least reactive. That is the reason, alkanes are called paraffins, para means less and affins means affinity of reactivity.

4. What do you know about hydrogenation of alkenes?

(DGK-I, SRG-II)(ALP)

**Ans. Hydrogenation of alkenes:**

Hydrogenation means addition of molecular hydrogen to an unsaturated hydrocarbon in the presence of a catalyst (Ni, Pt) to form saturated compound.



On industrial scale, this reaction is used to convert vegetable oil into margarine (banaspati ghee).



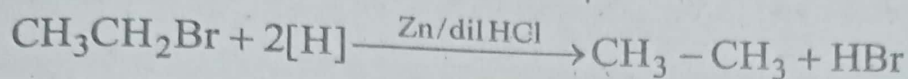
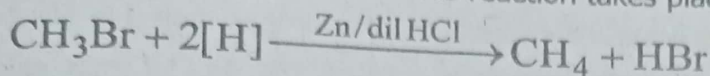
**Equation:**  $\text{Oil} + \text{H}_2 \xrightarrow{\text{Ni}} \text{Margarine (Banaspatti ghee)}.$

5. **How alkyl halides are reduced?**

(BWP-II, SWL-I, MLT-II, RWP-I, LHR-I)(ALP)

**Ans. Reduction of alkyl halides:**

Reduction means addition of nascent hydrogen. In fact, it is a replacement of a halogen atom with a hydrogen atom. This reaction takes place in the presence of Zn metal and HCl



6. **Why the alkanes are used as fuel?**

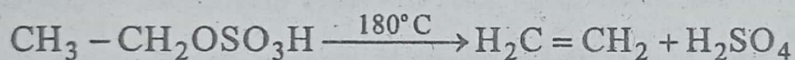
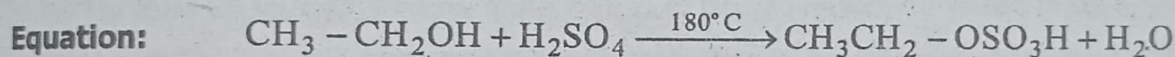
**Ans.** Alkanes burn in the presence of excess of air or oxygen to produce a lot of heat carbon dioxide and water. This reaction takes place in automobile combustion engines, domestic heaters and cooking appliances. It is highly exothermic reaction and because of it, alkanes are used as fuel.

**Equation:**  $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{heat}$

7. **How can you prepare ethene from alcohol and ethyl bromide?**

**Ans. i) Dehydration of alcohol:**

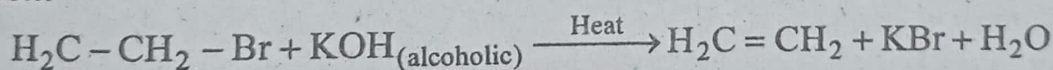
Ethene is prepared by heating a mixture of ethanol and excess of concentrated sulphuric acid at  $180^\circ\text{C}$ . In first step, ethyl hydrogen sulphate is formed which decomposes on heating to produce ethene, which is collected over water.



ii) **Dehydrohalogenation of alkyl halides:**

On heating ethyl bromide with alcoholic KOH, ethane is formed. Removal of hydrogen and halogen takes place from adjacent carbon atoms to create a double bond.

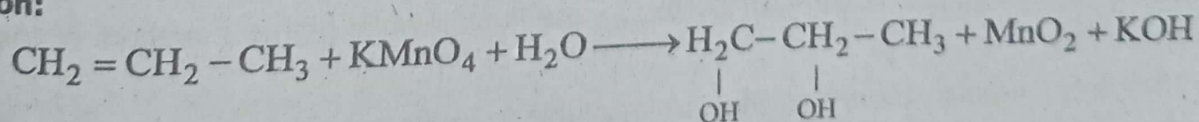
**Equation:**



8. **Identify propane from propene with a chemical test.**

**Ans.** Propene decolourises the pink colour of acidified dilute solution of potassium permanganate because of reactivity of double bond electrons with  $\text{MnO}_4^-$  ion, which further goes on reaction to eliminate  $\text{MnO}_2$  with the formation of colorless propane glycol such as, there is addition of 'hydroxyl group' at the double bond.

**Equation:**



(DGK-I)(ALP)

9. **Why the alkenes are called 'olefins'?**

**Ans.** Alkenes are also known as olefins (a Latin word meaning oil forming) because first members of alkene series form oily products when react with halogens.

(DGK-I)(ALP)

10. **Why alkane can't be oxidized with  $\text{KMnO}_4$  solution?**

**Ans.** Alkane does not decolourise the pink colour of acidified dilute solution of potassium permanganate solution and can't be oxidized because there is no double or triple bond present in alkane. Therefore alkane cannot be oxidized with  $\text{KMnO}_4$  solution.



**11. What are the addition reactions? Explain with an example.** (MLT-I, BWP-I, GUJ-I) (ALP)

**Ans.** These are the reactions in which the products are formed by the addition of some reagents like  $H_2, Cl_2$ , etc. to an unsaturated organic compound. In this process, one of the double bond gets broken and two new single bonds are formed.

**Example:**  $CH_2 = CH_2 + H_2 \xrightarrow{Ni} CH_3 - CH_3$

**Hydrogenation of alkenes:** Hydrogenation means addition of hydrogen molecule ( $H_2$ ), to an unsaturated hydrocarbon in the presence of a catalyst (Ni, Pt) to form saturated compound.

**12. Justify that alkanes give substitution reactions.**

**Ans.** Alkanes give only substitution reaction as in alkanes all bonds are single bonds which are very strong. In substitution reaction, one or more hydrogen atoms of a saturated compound are replaced with some other atoms (like halogen). These reactions are characteristic property of alkanes because only these are saturated compound having single bond.

**13. Both, alkenes and alkynes are unsaturated hydrocarbons. State the one most significant difference between them.**

**Ans.** Both, alkenes and alkynes are unsaturated hydrocarbons. The most significant difference between them is that alkenes are unsaturated having double bond present between carbon atoms and are capable of adding one molecule of reagent while alkynes are unsaturated having triple bond present between carbon to carbon atom and are capable of adding two molecules of reagent. Alkenes are shown as  $>C=C<$  and alkynes as  $-C\equiv C-$ . The general formula of alkene is  $C_nH_{2n}$  and that of alkyne is  $C_nH_{2n-2}$ .

**14. Write the molecular, dot and cross and structural formula of ethyne.**

**Ans.** The dot and cross formula of ethyne is:  $H \times \cdot C \equiv C \cdot \times H$

Structural formula of ethyne is:  $H - C \equiv C - H$

Molecular formula of ethyne is:  $C_2H_2$

**15. Why hydrocarbons are soluble in organic solvents?**

**Ans.** Because all the hydrocarbons are non-polar in nature. According to the rule "like dissolves like". The non-polar hydrocarbons are soluble in non-polar organic solvents.

**16. Give the physical properties of alkanes.**

**Ans.** (i) Alkanes form a homologous series of compounds. First four members of the series are gases. The alkanes consisting of  $C_5$  to  $C_{10}$  are liquids while higher members of the series are solids.

(ii) They are non-polar, therefore, they are insoluble in water but soluble in organic solvents.

(iii) The density of alkanes increases gradually with the increase of molecular size.

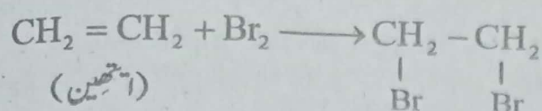
(iv) The melting and boiling points of alkanes increase regularly with the increase of molecular sizes. This is because of increase of attractive forces between the molecules of alkanes.

**17. How can you identify ethene from ethane?**

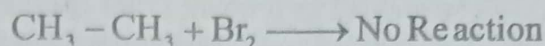
**Ans.** When ethene reacts with Bromine water. The red brown colour of Bromine water disappears. But when ethane reacts with bromine water. There is no change in colour, no reaction takes place.



**Equation:**



## Ethene



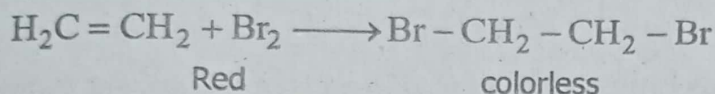
## Ethene

While ethane does not decolorize the pink colour of  $\text{KMnO}_4$  as it is saturated one. In this way, we can identify ethene from ethane.

18. Why colour of bromine water discharges on addition of ethane in it?

**Ans.** Halogenation means addition of halogen like  $\text{Cl}_2$   $\text{Br}_2$ . When bromine water (solution of bromine in water having red colour) is added to ethene in an inert solvent like carbon tetrachloride, its colour is discharge at once.

**Equation:**



In this reaction double bond of ethene is converted into a single bond by addition of a molecule of bromine. This reaction can occur if there is un-saturation of compound. As alkane; ethane has single bond among carbon-carbon atom, can't undergo addition reaction on reaction with bromine. In this way, ethane can be identified from ethene by using solution of bromine water.

**19. State one important use of each:**

### i. Ethene

## ii. Acetylene

### iii. Chloroform

iv. Carbon tetrachloride

**Ans. i. Ethene:** For artificial ripening of fruits.

ii. **Acetylene:** Acetylene produces oxy-acetylene flame with oxygen. It is a highly exothermic reaction. Heat released is used for welding purposes.

iii. **Chloroform:** Chloroform is used as a solvent for rubber, waxes, etc. and for anesthesia.

iv. Carbon tetrachloride:

Carbon tetrachloride is used as an industrial solvent and in dry cleaning.

## Extensive Questions

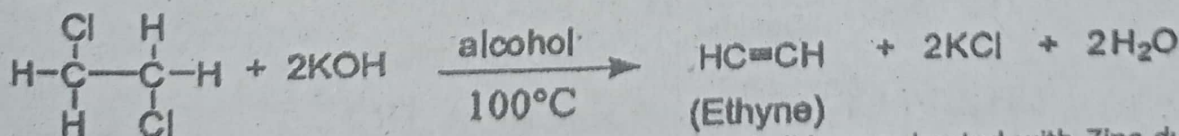
**1. Write a note on preparation of alkynes.**

[RWP-GI-21](ALP)

**Ans. Preparation of Alkynes:**

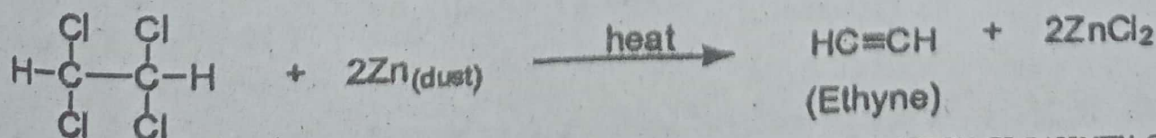
(i) **Dehydrohalogenation of vicinal dihalides:** When a vicinal dihalide is heated with alcoholic KOH, two hydrogen atoms along with two halogen atoms are removed from two adjacent atoms with the formation of a triple bond between the adjacent carbons:

**Equation:**



(ii) **Dehalogenation of tetrahalides:** When alkyl tetrahalides are heated with Zinc dust, the elimination of halides takes place to form ethyne.

**Equation:**



[SWL-21][DGK-GI-21][MTN-GI-21](ALP)

2. Write the uses of acetylene.

**Ans:** **Uses of Acetylene:** (i) It is used for the ripening of fruits.

**Ans: Uses of Acetylene:** (i) It is used for the ripening of fruits.  
(ii) Acetylene produces oxy-acetylene flame with oxygen. It is a highly exothermic reaction. Heat released is used for welding purposes.



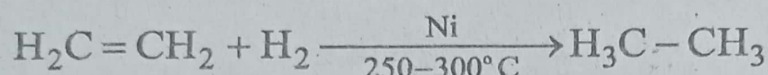
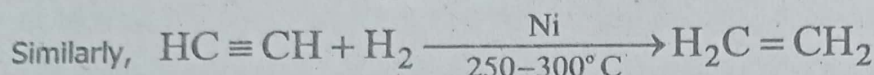
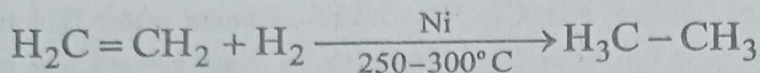
- (iii) It is polymerized to form benzene, which is used as raw material to form a variety of organic compounds.
- (iv) Acetylene is used to prepare other chemicals, such as, alcohol, acetaldehyde and acids.
- (v) It is used for the manufacturing of polymer products like polyvinyl chloride, polyvinyl acetate and synthetic rubber like neoprene.

3. Write two methods to prepare Alkanes and explain.

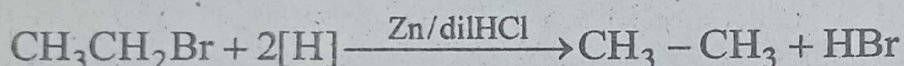
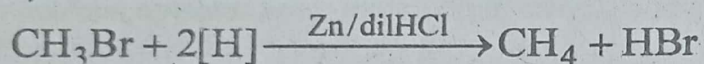
[RWP-GII-21][DGK-GII-21](ALP)

Ans: (1) **Hydrogenation of alkenes and alkynes:**

**Hydrogenation:** "Hydrogenation means addition of hydrogen in alkenes and alkynes". This reaction is carried out in the presence of nickel catalyst at 250°C to 300°C.



- (2) **Reduction of alkyl halides:** Reduction: "Reduction means addition of nascent hydrogen." It is a replacement of a halogen atom with a hydrogen atom. This reaction takes place in the presence of Zn metal and HCl.



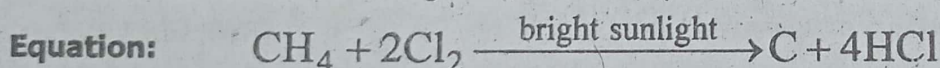
4. What type of reactions are given by alkanes? Explain with reference to halogenation of alkanes.

[GUJ-GI-21][SGD-GII-21](ALP)

Ans: **Substitution reaction:**

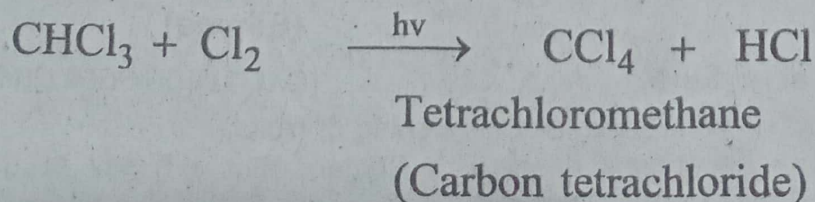
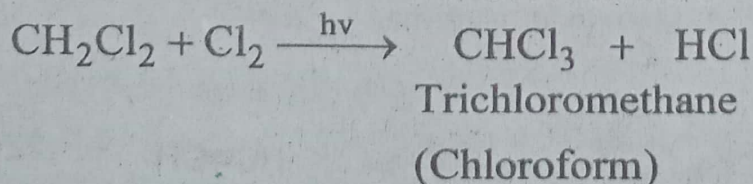
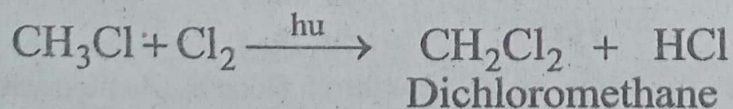
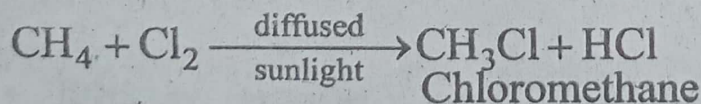
"A reaction in which one or more hydrogen atoms of a saturated compound are replaced with some other atoms (like halogen) is called a substitution reaction."

Alkanes give only substitution reactions. These reactions are a characteristic property of alkanes. Alkanes react fairly with halogens in diffused sunlight only. In dark there is no reaction. In direct sunlight reaction is explosive and carbon is deposited.



In diffused sunlight, a series of reactions take place and at each step one hydrogen atom is substituted by halogen atoms, so that all the hydrogen atoms are substituted by halogen atoms, so that all the hydrogen atoms are substituted one by one by halogen atoms.

**Equations:**





## Chapter

13

## Biochemistry

All Punjab Past Board Papers  
2014 - 2021

## ALP Annual Paper 2021

## MCQ's

- Which is reducing sugar? (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Glucose (B) Maltose (C) Sucrose (D) Starch
- General formula of carbohydrates is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A)  $C_nH_n$  (B)  $C_n(H_2O)_n$  (C)  $C_n(OH)_n$  (D) none of these

2014 - 2020

## 13.1

## Carbohydrates

- Lactose consists of glucose and: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A) sucrose (B) maltose (C) starch (D) galactose
- The most important oligo saccharide is: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
(A) sucrose (B) glucose (C) fructose (D) maltose
- Which one of the following is crystalline solid? (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Glucose (B) Starch (C) Cellulose (D) Glycogen
- Glucose is a: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) Hexahydroxy aldehyde (B) Pentahydroxy aldehyde  
(C) Pentahydroxy ketone (D) Hexahydroxy ketone
- Pentahydroxy aldehyde is called: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
(A) glucose (B) fructose (C) starch (D) sucrose
- Chemical Formula of Fructose is: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $C_{12}H_{22}O_{11}$  (B)  $C_6H_{12}O_6$  (C)  $C_4H_{10}$  (D)  $C_5H_{12}$
- Maltose is generally found in:- (SGD-I/II, DGK-II, SWL-II)  
(A) Milk (B) Cereals (C) Dairy products (D) Cotton
- Fatty acids are the building blocks of: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A) lipids (B) protein (C) glucose (D) vitamin

## 13.2

## Proteins

- Which one of the following is triglyceride: (LHR-GI, II, FSD-GII, DGK-GII, BWP-GI, II, SWL-GII, I)  
(A) Carbohydrates (B) Proteins (C) Lipids (D) Vitamins
- Formula of stearic acid is: (SGD-GI, RWP-GI, LHR-GII)  
(A)  $C_{17}H_{35}COOH$  (B)  $C_{17}H_{33}COOH$  (C)  $C_{17}H_{37}COOH$  (D)  $C_{15}H_{31}COOH$
- Proteins make up \_\_\_\_\_ percentage of the dry weight of animal cell: (FSD-GI, DGK-GI)  
(A) 25 (B) 50 (C) 75 (D) 100



**14. Rancid butter has a foul smell because of:**

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

- (A) Butanoic acid (B) Nitric acid (C) Tartaric acid (D) Sulphuric acid

**15. Formula of Palmitic acid is:**

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

- (A)
- $C_5H_{11}COOH$
- (B)
- $C_{18}H_{37}COOH$
- (C)
- $C_{17}H_{35}COOH$
- (D)
- $C_{15}H_{31}COOH$

**16. The organic compounds used as drugs to control bleeding are:**

(SGD-I/II, DGK-II, SWL-II)

- (A) Vitamins (B) Proteins (C) Lipids (D) Glycerides

**17. Amino Acids are link to each other through:**

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

- (A) Hydrogen Link (B) Ionic Link (C) Gelatin Link (D) Peptide Link

**18. The organic compounds used as drugs to control bleeding are:**

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

- (A) Vitamins (B) Proteins (C) lipids (D) glycerides

**19. Enzymes are proteins, which one the following properties they do not have?**

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

- (A) They catalyze reaction (B) They are not specific
- 
- (C) They are highly efficient (D) They are produced by living cells

**20. Number of amino acids in proteins is:**

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

- (A) 1000 (B) less than 10,000 (C) more than 10000 (D) 2000

**21. Amino acids which cannot be synthesized by our body:**

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

- (A) Non Essential (B) Proteins (C) Essential (D) Amino acids

**13.3****Lipids****13.4****Nucleic Acids****13.5****Vitamins****22. DNA consist of:**

[LHR-II, GUJ-II, MTN-II, SWL-I]

- (A) Ribose (B) Pentose (C) Deoxyribose sugar (D) Phosphate

**23. Watson and crick discover the structure of DNA in:**

[MTN-I, GUJ-I, FSD-II, SWL-I/II]

- (A) 1950 (B) 1952 (C) 1953 (D) 1955

**24. Which vitamin is fat soluble:**

[FSD-I, DGK-II, BWP-II, SGD-I]

- (A) A (B) E (C) K (D) All of these

**25. Eye inflammation is caused by the deficiency of vitamin:**

[FSD-I, DGK-II, BWP-II, SGD-I]

- (A) Vitamin D (B) Vitamin C (C) Vitamin B (D) Vitamin A

**26. The Night blindness is because of deficiency of:**

[LHR-I, GUJ-II, RWP-I, MTN-I/II]

- (A) Vitamin A (B) Vitamin E (C) Vitamin (D) Vitamin E

**27. Which vitamin is soluble in water?**

[GUJ-I, FSD-II, DGK-II, RWP-I]

- (a) Vitamin A (B) Vitamin C (C) Vitamin D (D) Vitamin D

**28. Which one of the following is a fat soluble vitamin?**

[RWP-I, GUJ-I, MTN-I, SGD-II]

- (A) Vitamin A (B) Vitamin B (C) Vitamin C (D) All of these



29. Deficiency of Vitamin E causes:

(A) Scurvy

(B) Rickets

(C) Night Blindness

[MTN-II, DGK-I, SWL-II]

(D) Anemia

### Answers

|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | A | 2  | B | 3  | D | 4  | A | 5  | A | 6  | B | 7  | A | 8  | B | 9  | B | 10 | A |
| 11 | C | 12 | A | 13 | B | 14 | A | 15 | D | 16 | B | 17 | D | 18 | B | 19 | B | 20 | C |
| 21 | C | 22 | C | 23 | C | 24 | D | 25 | D | 26 | A | 27 | B | 28 | A | 29 | D |    |   |

### ALP Annual Paper 2021

#### Short Questions

1. Define carbohydrates, write their general formula.

(LHR-GI, DGK-GI, II, SGD-GI)

Ans: **Carbohydrates:** Carbohydrates are macromolecules defined as polyhydroxy aldehyde or Ketones.

General formula. They have general formula  $C_n(H_2O)_n$

2. Give the characteristics of polysaccharides. (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: (i) They are amorphous solids. (ii) They are tasteless and insoluble in water.  
(iii) They are non reducing in nature.

3. What are Monosaccharides?

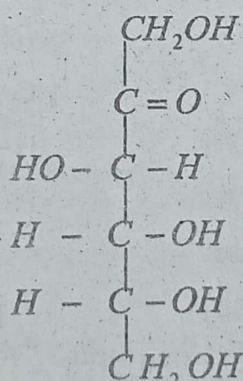
(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: **Monosaccharides:** Monosaccharides are the simplest sugars which cannot be hydrolyzed. They consist of 3 to 9 carbon atoms. Therefore, they are classified according to the number of carbon atoms in their molecules as trioses, tetroses, pentoses, hexoses, and so on. The important monosaccharides are hexoses like glucose and fructose.

4. Write structural formula of fructose.

(SGD-I/II, DGK-II, SWL-II)

Ans: **Structure formula of Fructose:**



5. What is the difference between Essential and Non-essential Amino Acids.

(MTN-GII, LHR-I, SWL-GI, MTN-GI, GUJ-GI, II, SGD-GI)

Ans:

| Essential Amino Acids   | Non-essential Amino Acids  |
|---|--|
| (i) Ten out of twenty amino acids which cannot be synthesized by human body are called essential amino acids. | (i) The amino acids which can be synthesized by human body are called essential amino acids. They are also ten in numbers. |
| (ii) These amino acids are required by human body and must be supplied through diet.                          | (ii) These amino acids are not required by human body and so there is no need to take them through diet.                   |

6. Define proteins and name its basic unit.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: **Proteins:** Proteins are highly complicated nitrogenous compounds made up of amino acids. Amino acids are basic units of proteins.



**Basic unit:** Amino acid is the basic unit of protein. Amino acids are organic compounds consisting of both amino and carboxyl group.

7. Write the chemical formulas of palmitic acid and stearic acid.

(MTN-GI, LHR-GI, SWL-GI)

Ans: Palmitic acid  $C_{15}H_{31}COOH$       Stearic acid  $C_{17}H_{35}COOH$

8. What is difference between ghee and oil? (FSD-GII, DGK-GII, SWL-GII, MTN-GI, II, GUJ-GII)

Ans:

| Oil   | Ghee  |
|---|---|
| (i) Oils exist in liquid form at room temperature.      | (i) While Ghee exist in solid form at room temperature. |
| (ii) They are triglycerides of unsaturated fatty acids. | (ii) They are triglycerides of saturated fatty acids.   |

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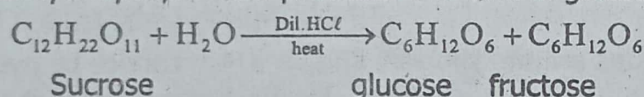
### 13.1

### Carbohydrates

9. Give the balanced equation for the hydrolysis of sucrose.

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

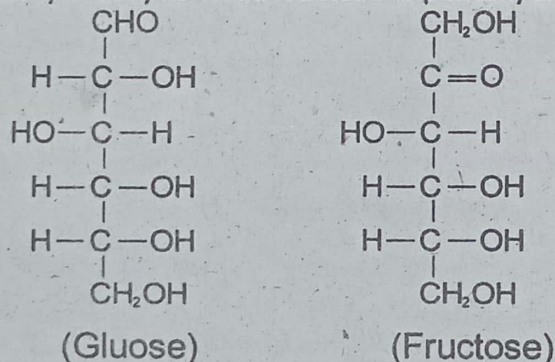
Ans: On hydrolysis, sucrose produces one unit of glucose and one unit of fructose.



10. What is the difference between glucose and fructose?

(SWL-GI, II, RWP-GII, GUJ-GI, LHR-GI, GII, SGD-GII)

Ans: Glucose is a pentahydroxy aldehyde while fructose is pentahydroxy ketone.

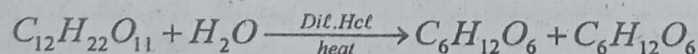


11. What are oligosaccharides? Give example. (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Oligosaccharides give 2 to 9 units of monosaccharides on hydrolysis.

These carbohydrates are white, crystalline solids easily soluble in water. They are also sweet in taste. They may be reducing or non-reducing.

**Example:** The most important oligosaccharides are disaccharides like sucrose.



12. Describe sources of sucrose and starch.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

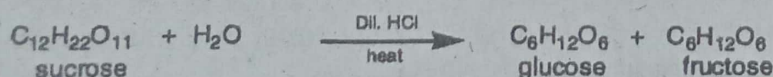
Ans: Sucrose is found in sugar beet, sugar cane and fruits, while starch is found in cereal crops, wheat, barley, maize, rice etc.

13. How Disaccharides are Hydrolyzed to Monosaccharides?

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: The most important oligosaccharides are disaccharides like sucrose.

On hydrolysis, sucrose produces one unit of glucose and one unit of fructose.





14. Define polysaccharides and give one example.

(GUJ-GI, RWP-GII, DGK-I, II, BWP-GI, LHR-GI, SWL-GII)

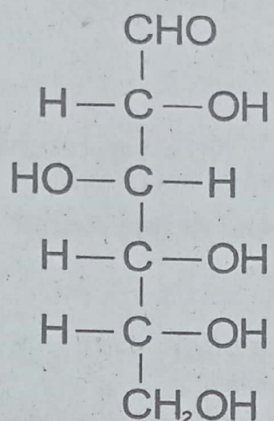
**Ans: Polysaccharides:** Polysaccharides are macromolecular carbohydrates consisting of hundreds to thousands of monosaccharides.

Examples of polysaccharides are starch and cellulose.

15. Write structural formula of glucose.

(GUJ-GI, SWL-GI, LHR-GII, DGK-GI)

**Ans: Structural formula of glucose:**



16. What are carbohydrates? Write names of three classes.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans: Carbohydrates:**

Carbohydrates are macromolecules defined as poly hydroxyl aldehydes or ketones.

They have general formula.  $\text{C}_n(\text{H}_2\text{O})_n$

**Example:** Glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ )

Sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ )

**Names of Classes:** Monosaccharides, oligosaccharides and polysaccharides.

17. Give the characteristics of disaccharides (any two).

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans:** i. Disaccharides are sweet in taste. ii. They are easily soluble in water.

18. Give characteristics of oligosaccharides.

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans:** i. Disaccharides are white crystalline solids and sweet in taste.

ii. They are easily soluble in water.

19. Describe carbohydrates as source of energy. (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** Our body uses carbohydrates in the form of glucose. Glucose is the only form of carbohydrates that is used directly by muscles for energy. It is important to note that brain needs glucose as an energy source, because it cannot use fat for this purpose.

20. Define reducing sugar with example.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans. Reducing Sugar:** Monosaccharides are white crystalline solids. They are soluble in water and have sweet taste. They cannot be hydrolyzed. They are reducing in nature, therefore, these are called reducing sugars.

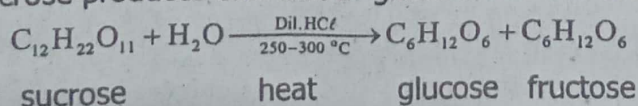
**Examples:** Glucose

21. Give an example of Disaccharide. How it is Hydrolyzed into Monosaccharides?

(SGD-I/II, DGK-II, SWL-II)

**Ans.** The most important oligosaccharides are disaccharides like sucrose.

On hydrolysis, sucrose produces one unit of glucose and one unit of fructose.

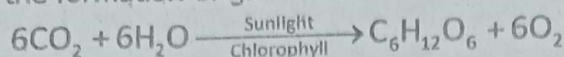




22. Write down the balanced equation for the formation of glucose.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Balanced equation for the formation of glucose:



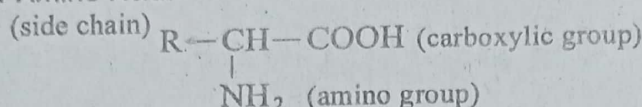
### 13.2

### Proteins

23. Give general formula of amino acid.

(LHR-GI, FSD-GII, GI, MTN-GII, SGD-GI, II, DGK-GII)

Ans: General Formula of Amino Acid:



Side chain 'R' is different for different amino acids.

24. What is meant by Non-essential Amino Acids?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Non-essential Amino Acids:

Those amino acids which can be synthesized by human body are called non-essential aminoacids. These are ten in number.

25. How many Amino acids are synthesized by Human body?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans. Those amino acids which can be synthesized by human body are called non-essential aminoacids. These are ten in number.

### 13.3

### Lipids

26. Differentiate between oil and Fat?

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

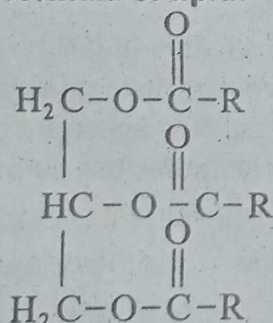
Ans:

| Oil   | Fat  |
|---|--|
| (i) Oils exist in liquid form at room temperature.      | (i) While Fat exist in solid form at room temperature. |
| (ii) They are triglycerides of unsaturated fatty acids. | (ii) They are triglycerides of saturated fatty acids.  |

27. Write down the general formula of lipids.

(LHR-GII, RWP-GI, II, FSD-GII, SGD-GII)

Ans: General formula of lipid:



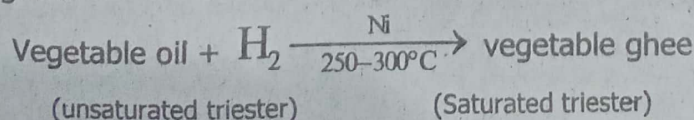
28. What is Hydrogenation of vegetable oil? Write equation.

(SGD-I/II, DGK-II, SWL-II)

Ans: Hydrogenation of Vegetable oil:

When hydrogen is passed through vegetable oil in presence of nickel catalyst at

250-300°C, ghee is formed. This Process is called hydrogenation of vegetable oil. Ghee is also called margarine





29. Define Lipids.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: **Lipids:** "Lipids include oils and fats. Oils and fats are esters of long chain carboxylic (fatty) acids with glycerol. For example all oils and fats.

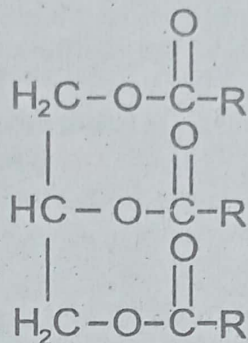
30. Write the formula of palmitic acid. (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans. The formula of palmitic acid is:  $C_{15}H_{31}COOH$

31. Write the Structural Formula of Triglycerides

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans. General formula of triglycerides is as under.



32. Shortly brief that Plants are source of Oil. (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Plants synthesize oils and store them in seeds, such as sunflower oil, coconut oil, groundnut oil and corn oil. These oils are used as vegetable oils or ghee for cooking and other purposes.

33. Write formulas of the following:-

[FSD-II, SGD-I, GUJ-I, BWP-II, SWL-I]

(i) Palmitic Acid (ii) Stearic Acid

Ans. (i) Palmitic acids:  $C_{15}H_{31}COOH$

(ii) Stearic Acid:  $C_{17}H_{35}COOH$

### 13.4

### Nucleic Acids

34. What is Ribonucleic Acid (RNA)?

[SGD-II, MTN-I, DGK-I]

Ans. **Ribonucleic acid (RNA):**

It consist of ribose sugar. It is a single stranded molecule. Its role is like a messenger.

35. What do you mean by genetic code of life?

[SGD-II, FSD-II, MTN-I, DGK-I]

Ans. These instructions are 'Genetic code of life'. They determine whether an organism is a man or a tree or a donkey and whether a cell is a nerve cell or a muscle cell. When an error occurs in any of the steps involved in expressing the genetic information contained in DNA a genetic disease may occur.

DNA carries genes that controls the synthesis of RNA and passes the genetic information to RNA at proper time.

36. Write about the work of Ribonucleic Acid.

[LHR-II, MTN-I, DGK-II]

Ans. **Ribonucleic acid (RNA):**

It consist of ribose sugar. It is a single stranded molecule. It is responsible for putting the genetic information to work in the cell to build proteins. Its role is like a messenger.

### 13.5

### Vitamins

37. Write sources of Vitamins A and D?

[LHR-II, GUJ-I, SGD-II, MTN-II, RWP-I]

Ans. **Vitamin A:** Dairy products, eggs, oils and fats, fish. It can also be obtained from the beta-carotene found in green vegetables, carrots and liver.

**Vitamin D:** Fish liver, dairy products, oils and fats. Vitamin D is formed in the skin when it is exposed to sunlight.



38. Write uses of Vitamin-D.

[SWL-II, FSD-I, GUJ-II, BWP-II, MTN-I]

Ans. Vitamin D has a role in the absorption of calcium, which is essential for the maintenance of healthy bones.

39. What are Fat Soluble Vitamins? Write their examples. [BWP-II, MTN-I, FSD-II, SWL-I]

Ans. Fat soluble Vitamins: "The vitamins which dissolve in fats are called fat soluble vitamins".  
Examples:

- i. Vitamin A      ii. Vitamin D      iii. Vitamin E      iv. Vitamin K

40. Write down the sources and uses of Vitamin 'A'. [BWP-II, MTN-I, GUJ-II]

Ans. Vitamin A: Sources: Dairy products, eggs, oils and fats, fish. It can also be obtained from the beta-carotene found in green vegetables, carrots and liver.

Uses: Maintains the health of the epithelium and acts on the retina's dark adaptation mechanism.

41. Why excessive use of vitamin D is harmful.

[LHR-II, SGD-II, DGK-I, MTN-II, FSD-I/II, BWP-II, SWL-I]

Ans. Accumulation of vitamin D in the body. Cause bone pain and bone like deposits in the kidney.

42. What are Vitamins?

[GUJ-I/II, FSD-I, MTN-I, RWP-II, SGD-I, SWL-II]

Ans. In 1912 Hopkins noticed that in addition to carbohydrates, proteins and fats there are other substance needed for normal growth. Although these substances were needed in small quantity, yet these substances were called Accessory Growth Factors. Later Funk proposed the name 'Vitamin' for these substances. He discovered vitamin B1 (Thiamin).

## Solved Exercise

### Multiple Choice Questions

1. Carbohydrates are synthesized by plants through photosynthesis process which requires the following except:

- (a)  $\text{CO}_2$  and water      (b) presence of sunlight  
(c)  $\text{O}_2$       (d) chlorophyll

2. Which of the followings is a disaccharide?

(DGK-I, MLT-I, SRG-II, BWP-I, GUJ-I)(ALP)

- (a) Glucose      (b) Fructose      (c) Sucrose      (d) Starch

3. Photosynthesis process produces:

- (a) Starch      (b) Glucose      (c) Fructose      (d) Sucrose

4. Which one of the following is tasteless?

(DGK-II, MLT-II, BWP-II)(ALP)

- (a) Starch      (b) Glucose      (c) Fructose      (d) Sucrose

5. When glucose and fructose combine they produce:

(RWP-I)(ALP)

- (a) Starch      (b) Cellulose      (c) Sucrose      (d) None of these

6. Glucose is:

(FSD-I, LHR-I)(ALP)

- (a) Hexahydroxy aldehyde      (b) Hexahydroxy ketone  
(c) Pentahydroxy aldehyde      (d) Pentahydroxy ketone

7. Thousand of amino acids polymerize to form:

(RWP-II)(ALP)

- (a) Carbohydrates      (b) Proteins  
(c) Lipids      (d) Vitamins

8. Which one of following is a triglyceride?

- (a) Carbohydrates      (b) Proteins  
(c) Lipids      (d) Vitamins

9. Enzymes are proteins which have the following properties except:

- (a) They catalyze reaction      (b) They are highly non-specific  
(c) They are highly efficient      (d) They are produced by living cells

10. Which one of the following vitamins is water soluble?

- (a) Vitamin A      (b) Vitamin C      (c) Vitamins D      (d) Vitamins E



11. Which one of the following is a fat soluble vitamin?  
(a) A (b) E (c) K (d) All of these
12. Which one of the following is not the characteristics of monosaccharide?  
(a) WHITE crystalline solids (b) Soluble in water  
(c) Hydrolysable (d) Reducing in nature
13. Which one of the following statements about glucose and sucrose is incorrect?  
(a) Soluble in water (b) Naturally occurring  
(c) Carbohydrates (d) Disaccharides
14. Which one of the followings is a reducing sugar? (SWL-I)(ALP)  
(a) Glucose (b) Fructose (c) Sucrose (d) Starch
15. The most important oligosaccharide is:  
(a) Sucrose (b) Glucose (c) Fructose (d) Maltose
16. Night blindness is because of deficiency of:  
(a) Vitamin A (b) Vitamin E (c) Vitamins C (d) Vitamin D
17. The organic compounds used as drugs to control bleeding are:  
(a) Vitamins (b) Proteins (c) Lipids (d) Glycerides
18. Deficiency of Vitamin E causes:  
(a) Rickets (b) Scurvy  
(c) Anemia in babies (d) Night blindness
19. Lipids are macromolecules. They have characteristics except one of the followings:  
(a) They are high energy foods (b) They are soluble in water  
(c) They are poor conductor of heat (d) They are esters of fatty acids
20. Vitamins are Accessory Growth Factors. They play important role in our body like:  
(a) Provide are high energy food  
(b) Insulate our body form electric shock  
(c) Build brain cells (d) Regulate metabolic process

### Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | c | 2  | b | 3  | a | 4  | a | 5  | c |
| 6  | c | 7  | b | 8  | c | 9  | b | 10 | b |
| 11 | d | 12 | c | 13 | d | 14 | a | 15 | a |
| 16 | a | 17 | b | 18 | c | 19 | b | 20 | d |

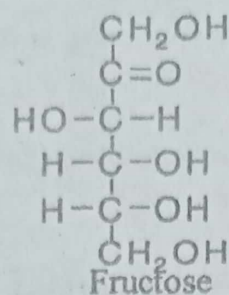
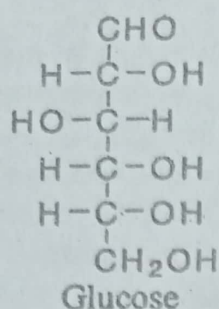
### Short Questions

1. How plants synthesize carbohydrates? (BWP-I)(ALP)  
**Ans.** Carbohydrates are synthesized by plants through photosynthesis process from carbon dioxide and water in the presence of sunlight and green pigment chlorophyll.  
**Equation:** 
$$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$

The glucose is further polymerized to form starch and cellulose.
2. Give the characteristic of monosaccharides. (SWL-I,DGK-I)(ALP)  
**Ans.** i. Monosaccharides are white crystalline solids.  
 ii. They are soluble in water. iii. They have sweet taste.  
 iv. They cannot be hydrolyzed.  
 v. They are reducing in nature therefore they are called reducing sugars.
3. What is difference between glucose and fructose?  
**Ans.** **Glucose:** Glucose is a pentahydroxy aldehyde.  
**Fructose:** Fructose is a pentahydroxy ketone.

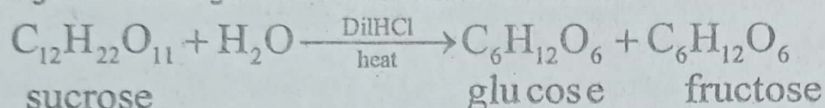


### Structures:



4. Give an example of a disaccharide. How it is hydrolyzed into monosaccharides?

**Ans.** The most important disaccharides is sucrose which can be hydrolyzed into monosaccharides on producing one unit of glucose and one unit of fructose.



**Equation:**

**5. Give the characteristics of polysaccharides.**

**Ans.** i. They are amorphous solids. ii. They are tasteless  
iii. They are insoluble in water. iv. They are non-reducing in nature.

6. Where the proteins are found?

(BWP-I)(ALP)

**Ans.** Proteins are present in all living organisms. They make up bulk of the non-bony structure of the animal bodies. They are major component of all cells and tissues of animals.

About 50% of the dry weight of cell is made up of proteins. They are found in muscles, skin, hair, nails, wools and feathers, etc.

**7. Describe the uses of carbohydrates.**

**Ans. Uses of Carbohydrates:**

- i. They regulate the amount of sugar level in our body. Low sugar level in body results in hypoglycemia.
- ii. They provide essential nutrients for bacteria in intestinal tract that helps indigestion.
- iii. Dietary fiber helps to keep the bowel functioning properly.
- iv. Fiber helps in lowering of cholesterol level and regulates blood pressure.
- v. Carbohydrates protect our muscles from cramping.

8. Lactose is disaccharide; which monosaccharides are present in it?

**Ans.** Lactose is a disaccharide consisting of glucose and galactose.

9. Why the ten amino are essential for us?

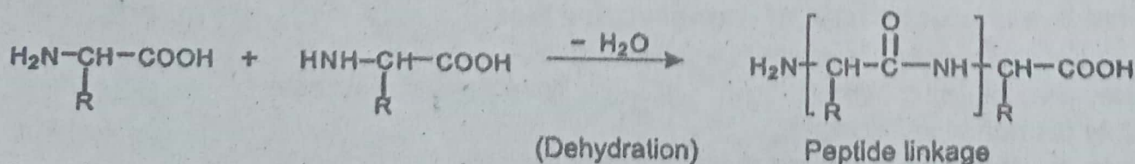
**Ans.** The ten amino acids are essential for us because our body cannot synthesize these amino acids. Essential amino acids are required by our bodies and must be supplied through diet.

## 10. How are proteins formed?

(MLT-I,DGK-I)(ALP)

Ans. Two amino acids link through peptide linkage. Peptide linkage (bond) is formed by the elimination of water molecule between the amino group of one amino acid and carboxylic acid group of another amino acid, such as:

**quation:**



When thousand of amino acids polymerize, they form proteins.

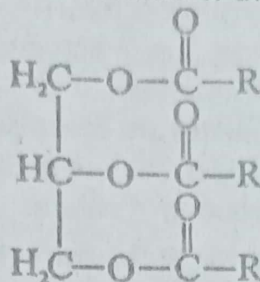
### How is gelatin obtained?

5. Proteins are found in bones. When bones are heated they give gelatin. Gelatin is used to make bakery items.



12. Give the general formula of the lipids.

Ans. Lipids are triglycerides and the general formula of triglycerides (fat or oil) is as follows.



13. Name two fatty acids with their formulae.

(MLT-II, FSD-I)(ALP)

Ans. Examples of fatty acids with their formula are given as follows.

i.  $\text{C}_{15}\text{H}_{31}\text{COOH}$  is called palmitic acid ii.  $\text{C}_{17}\text{H}_{35}\text{COOH}$  is called stearic acid

14. Give the types of vitamins.

Ans. Vitamins are divided into two types.

i. **Fat soluble vitamins:** The vitamins which dissolve in fats are called fat soluble vitamins. They accumulate in the body and cause diseases. For example D, vitamins A, vitamin E and vitamin K.

ii. **Water soluble vitamins:** The vitamins which dissolve in water are called water soluble vitamins. These are vitamin B complex and vitamin C.

15. What is the significance of vitamins?

Ans. i. Each vitamin plays an important role in the healthy development of our body.

ii. They are absolutely necessary for our normal growth.

iii. They help to regulate our body's metabolism.

16. Describe the sources and uses of vitamin A.

Ans. **Sources:** Vitamin A is obtained by dairy products, eggs, oils and fats, fish. It can also be obtained from the beta-carotene found in green vegetables, carrots and liver.

**Uses:** Vitamin A is used to maintain the health of the epithelium and acts on the retina's dark adaption mechanism.

17. Justify water soluble vitamins are not injurious to health.

Ans. The water soluble vitamins dissolve in water very easily. Due to the solubility of these vitamins into water, they are rapidly excreted from the body and does not accumulate into body to cause disease. Hence these vitamins are non-toxic and not injurious to health even in large quantity.

18. What do you mean by genetic code of life?

Ans. DNA is the permanent storage place for genetic information in the nucleus of a cell. It carries and stores all genetic information of the cell. It passes these information as instruction from generation to generation how to synthesize particular proteins from amino acids. These instructions are called genetic code of life.

19. What is the function of DNA?

Ans. Proteins development in new cells is basically determined by the sequence of nitrogenous bases in DNA. DNA carries genes that control the synthesis of RNA that is ultimately responsible for the synthesis of proteins. Errors introduced into the genes cause the formation of faulty RNA. So to ensure the orderly arrangement of RNA as well protein, double helix of DNA must be properly sequenced.

20. How you justify RNA works like a messenger?

Ans. RNA consists of ribose sugar. It is a single standard molecule. It is responsible for putting the genetic information to work in the cell to build proteins. Its role is like messenger. RNA is synthesized by DNA to transmit the genetic information. RNA is then responsible for directing the synthesis of new protein.



### Extensive Questions

1. What are Polysaccharides. Give their properties.

[RWP-GI-21][SWL-21](ALP)

**Ans. Polysaccharides:** Polysaccharides are macromolecular carbohydrates consisting of hundreds to thousands of monosaccharides.

**Examples:** Examples of polysaccharides are starch and cellulose.

**Characteristics of Polysaccharides:** They are amorphous solids. They are tasteless and insoluble in water. They are non reducing in nature.

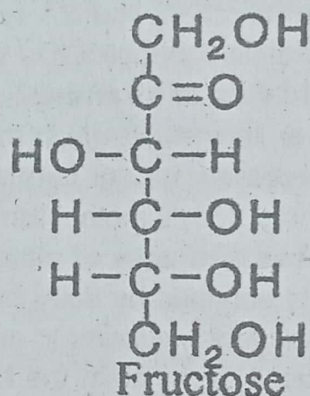
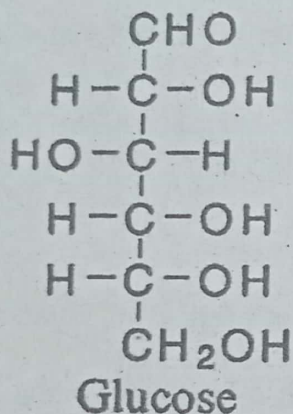
2. What are monosaccharides? Write their characteristics.

[SGD-GII-21][RWP-GII-21][DGK-GI-21][GUJ-GI-21](ALP)

**Ans:** "Monosaccharides are the simplest sugars which cannot be hydrolyzed. They consist of 3 to 9 carbon atoms".

**Classification of monosaccharides:**

They are classified according to the number of carbon atoms in their molecules as trioses, tetroses, pentoses, hexoses and so on. The important monosaccharides are hexoses like glucose and fructose. Glucose is pentahydroxy aldehyde while Fructose is pentahydroxy ketone having the open chain structures as follows and general formula .



Monosaccharides are white crystalline solids. They are soluble in water and have sweet taste.

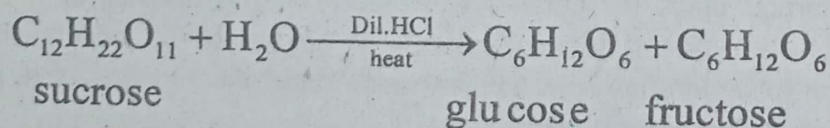
3. Write note on oligosaccharides.

[MTN-GI-21](ALP)

**Ans: Oligosaccharides:** "Oligosaccharides give 2 to 9 units of monosaccharides on hydrolysis. They are classified as disaccharides, trisaccharides, tetrasaccharides, etc, depending upon the number of units they produce on hydrolysis.

The most important oligosaccharides are disaccharides like sucrose. On hydrolysis sucrose produces one unit of glucose and one unit of fructose.

**Equation:**

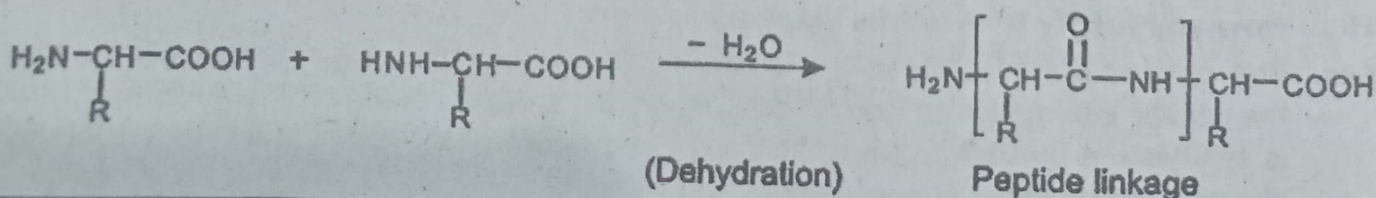


4. Explain that amino acids are building blocks of proteins.

[BWP-GI-21][MTN-GII-21][DGK-GII-21](ALP)

**Ans: Amino acids as building blocks of proteins:**

Two amino acid link through peptide linkage. Peptide linkage (bond) is formed by the elimination of water molecule between the amino group of one amino acid and carboxyl acid group of another, such as:





## Chapter

14

## The Atmosphere

All Punjab Past Board Papers  
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ALP Annual Paper 2021

## MCQ's

- Which gas is called green house gas? (SGD-I/II, DGK-II, SWL-II)  
(A)  $CO_2$  (B)  $CO$  (C)  $N_2$  (D)  $O_3$
- In which region, Ozone formation takes place? (BWP-I)  
(A) Troposphere (B) stratosphere (C) Thermosphere (D) Mesosphere

2014 - 2020

## 14.1

## Composition of Atmosphere

- About 99% of atmospheric mass lies with in: [RWP-II, DGK-I, SGD-II, MTN-I/II, BWP-I]  
(a) 10km (b) 20km (c) 30km (d) 40km
- How many percentage of sunlight is absorbed by atmospheric gases. [MTN-II, DGK-I, SGD-I]  
(a) 12% (b) 18% (c) 24% (d) 30%
- Depending upon temperature variation, atmosphere is divided.  
(a) One region (b) Two region (c) Three region (d) Four region
- Which sphere is above the surface of soil: [LHR-I, GUJ-I, RWP-II, FSD-I, DGK-I, BWP-II, SWL-II]  
(A) Mesosphere (B) Stratosphere (C) Thermosphere (D) Troposphere
- Stratosphere is at the height of: [RWP-II, SGD-II]  
(A) 0-12 km (B) 12-50 km (C) 50-85 km (D) 85-120 km

## 14.2

## Layers of Atmosphere

- At the height 85-120 km for earth's surface is: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A) Troposphere (B) Mesosphere (C) Stratosphere (D) Thermosphere
- Height of stratosphere from earth's surface is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
(A) 30km (B) 40km (C) 50km (D) 60km
- Which gas protects the earth's surface from ultraviolet radiations: (LHR-GI, II, RWP-GII, BWP-GI, RWP-GI, BWP-GII)  
(A)  $CO_2$  (B)  $CO$  (C)  $O_3$  (D)  $N_2$
- A strange bitter smell noticed near photo copier machine is of: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
(A)  $H_2S$  (B)  $SO_2$  (C)  $O_3$  (D)  $O_2$
- Temperature range of thermosphere is: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
(A)  $17^\circ C$  —  $58^\circ C$  decreases (B)  $-58^\circ C$  —  $2^\circ C$  increases  
(C)  $2^\circ C$  —  $93^\circ C$  decreases (D)  $> -93^\circ C$  increases



13. Temperature range of stratosphere is: (SGD-I/II, DGK-II, SWL-II)  
 (A)  $17^{\circ}\text{C} - -50^{\circ}\text{C}$  (B)  $-58^{\circ}\text{C} - 2^{\circ}\text{C}$  (C)  $2^{\circ}\text{C} - -93^{\circ}\text{C}$  (D)  $> -93^{\circ}\text{C}$

## 14.3

## Pollutants

14. Waste material that pollutes air, water and soil is termed as: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A) pollution (B) pollutant (C) solvent (D) solution
15. \_\_\_\_\_ is a secondary pollutant: (LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A)  $\text{SO}_2$  (B)  $\text{CO}_2$  (C)  $\text{CH}_4$  (D)  $\text{HCl}$
16. Which is secondary pollutant: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A)  $\text{H}_2\text{SO}_4$  (B)  $\text{CO}_2$  (C) CO (D)  $\text{SO}_3$
17. Life gas for plants is: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A) CO (B)  $\text{CO}_2$  (C)  $\text{CH}_4$  (D)  $\text{O}_2$

## 14.4

## Acid Rain and Its Effects

18. Buildings are being damaged by Acid Rain because it attacks: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A) Calcium Sulphate (B) Calcium Carbonate (C) Calcium Nitrate (D) Calcium Oxalate
19. The pH value of acid rain is: (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) 6 (B) 6.5 (C) 8 (D) 4

## 14.5

## Ozone Depletion and Its Effects

20. Which pollutant is not found in car exhaust gases: [SGD-I, MTN-II, FSD-I/II, BWP-II]  
 (A) CO (B)  $\text{O}_3$  (C)  $\text{NO}_2$  (D)  $\text{SO}_2$
21. Which gas protects the elements from ultraviolet radiations? [GUJ-II, MTN-II, DGK-I, BWP-II]  
 (a)  $\text{CO}_2$  (B) CO (C)  $\text{N}_2$  (D)  $\text{O}_3$
22. Ozone is formed in [GUJ-II, RWP-I, FSD-I, MTN-II, SWL-I]  
 (A) Troposphere (B) Stratosphere (C) Mesosphere (D) Thermosphere

## Answers

|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | A | 2  | B | 3  | C | 4  | B | 5  | D | 6  | D | 7  | B | 8  | D | 9  | C | 10 | C |
| 11 | C | 12 | D | 13 | B | 14 | B | 15 | D | 16 | A | 17 | B | 18 | B | 19 | B | 20 | B |
| 21 | D | 22 | B |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |

## ALP Annual Paper 2021

## Short Questions

1. What is the difference between Atmosphere and Environment?

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans. Atmosphere:** Atmosphere is the envelope of different gases around the Earth.

**Environment:** The surroundings or conditions in which a person, animal, or plant lives or operates is called environment.



2. **What do you mean by an Air Pollutant?**

**Ans:** The harmful substances present in air are called air pollutants. Even a beneficial substance beyond a specific concentration may be harmful. Air pollutants change the weather, badly affects the human health, damage the plants and destroy buildings.  
(BWP-GI,SGD-GII,DGK-GII)

**Example:** Oxides of sulphur, Oxides of carbon etc.

3. **How is acid rain produced?**

(LHR-GI,II,SWL-GI,MTN-GI,BWP-GII,RW-GI,)

**Ans: Acid rain:** Burning of fossil fuels produces oxides of sulphur and nitrogen in the air. Rain water converts  $\text{SO}_2$  into  $\text{H}_2\text{SO}_4$  and  $\text{NO}_x$  to  $\text{HNO}_2$  and  $\text{HNO}_3$ . Normal rain water is weakly acidic but rain water on dissolving air pollutants (acids) becomes more acidic and its pH reduces from 6 to 4.

Thus acid rain is formed on dissolving acidic air pollutants such as sulphur dioxide and nitrogen dioxide by rain water.

4. **Why acid rain damages buildings?**

(GUJ-GI,II,FSD-GII,DGK-GII,LHR-I)

**Ans:** Acid rain attacks the calcium carbonate present in the marble and limestone of buildings and monuments. Thus, these buildings are getting dull and eroded day by day.

5. **State any two effects of acid rain.**

(GUJ GII,RWP GII,BWP GII)

**Ans: Effects of Acid Rain:** (i) Acid rain attacks the calcium carbonate present in the marble and limestone of buildings and monuments. Thus these building are getting dull and eroded day by day.

(ii) It directly damages the leaves of trees & plants.

6. **Ozone is beneficial for human life, justify.**

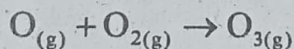
(GUJ-GI,SGD-GI,RWP-GI,FSD-GII,FSD-I)

**Ans:** Ozone layer protect earth like a shield from harmful ultraviolet radiations of sun light. Otherwise, ultraviolet radiations would cause skin cancer. Thus ozone layer in stratosphere is beneficial for life on the Earth.

7. **Define Ozone and Ozone hole.**

(SGD-GI,DGK-GI,LHR-GII)

**Ans: Ozone:** Ozone is an allotropic form of oxygen consisting of three oxygen atoms. It is formed in atmosphere by the association of an oxygen atom with an oxygen molecules in the mid of stratosphere.



**Ozone hole:** The region in which ozone layer depletes is called ozone hole.

Signs of ozone depletion were first noticed over Antarctica in 1980s. Since 1990s depletion has also been recorded over the Arctic, as well.

8. **Why are the flood risks increasing?**

(LHR-I/II,GUJ-I/II,FSD-I/II,MUL-I,SGD-II,DGK-I,SWL-I)

**Ans:** Due to greenhouse effect and global warming, average temperature of earth's surface is increasing dramatically. It is in turn causing the glaciers and snow caps to melt. Due to which, flood risks are increasing day by day.

9. **What is Ozone Hole? Where was it noticed first.**

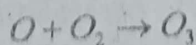
(BWP-I)

**Ans:** The region in which ozone layer depletes is called ozone hole. It was first noticed in 1980 in Antarctica.

(SWL-I)

10. **Define Ozone.**

**Ans: Ozone:** Ozone is an allotropic form of oxygen consisting of three oxygen atoms. It is formed in stratosphere.



(BWP-II)

11. **Where does Ozone layer exist.**

**Ans:** Ozone layer is found in stratosphere.

(DGK-I)(GUJ-I)(DGK-I)

12. **Write the number atmospheric regions.**

**Ans: Layers of atmosphere:** (i) Stratosphere (ii) Troposphere  
(iii) Thermosphere (iv) Mesosphere



13. Define primary pollutants. Give one example. (GUJ-I)

Ans: Primary pollutants are the waste of exhaust products driven out because of combustion of fossil fuels and organic matter.

Example:  $SO_2, SO_3$   
 $CO, CO_2$

# StudyNotes.pk

2014 - 2020

14.1

## Composition of Atmosphere

14.2

## Layers of Atmosphere

14. Write percentage composition of atmosphere by volume.

[LHR-I, RWP-II, DGK-I, SWL-III]

Ans.

| Gas            | % by Volume |
|----------------|-------------|
| Nitrogen       | 78.09       |
| Oxygen         | 20.93       |
| Argon          | 0.93        |
| Carbon dioxide | 0.03        |

15. Why 75% atmospheric mass is found in troposphere?

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: About 99% of atmospheric mass lies within 30 km and 75% of it is present within 11 km above from surface of earth. Since height of troposphere from surface of earth is 0-12 km, so 75% atmospheric mass is found in troposphere.

16. How many natural systems are formed on earth? Write their names.

(FSD-GI, LHR-GI, GUJ-GI)

Ans: Natural systems on earth:

There are four natural systems, present on earth;

(i) Lithosphere (ii) Hydrosphere (iii) Atmosphere (iv) Biosphere

17. Why is the temperature of upper stratosphere is higher?

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: The presence of ozone (due to absorption of radiation) in this region is responsible for the rise of temperature in stratosphere. Within this region, temperature increases as altitude increase, such as lower layer temperature is about  $-58^{\circ}\text{C}$  and upper layer is about  $2^{\circ}\text{C}$ .

18. Write down the range of height and temperature of mesosphere.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

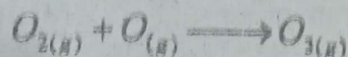
Ans.

| range      | Height     | Temperature  |
|------------|------------|--|
| Mesosphere | 50 - 85 km | $2^{\circ}\text{C} \text{ --- } -93^{\circ}\text{C}$ |

19. Why the concentration of Ozone in Stratosphere remains nearly constant?

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: The mid stratosphere has less UV light passing through it. Here O and  $O_2$  recombine to form ozone which is an exothermic reaction. Ozone formation in this region results in formation of ozone layer. Thus, ozone layer exists in mid stratosphere.





The lower stratosphere receives very low UV radiations, thus monoatomic oxygen is not found here and ozone is not formed here. It is the reason that concentration of Ozone in Stratosphere remains nearly constant.

**20. What is the temperature range of stratosphere and mesosphere?**

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Temperature range of Stratosphere is:  $-58^{\circ}\text{C}$  —  $2^{\circ}\text{C}$

Temperature range of Mesosphere is:  $2^{\circ}\text{C}$  —  $-93^{\circ}\text{C}$

**21. State the phenomenon of decreasing temperature in troposphere.**

(SGD-I/II, DGK-II, SWL-II)

Ans: In troposphere, as the concentration of gases decreases gradually with the increase of altitude, correspondingly temperature also decreases at a rate of  $6^{\circ}\text{C}$  per kilometer.

**14.3**

**Pollutants**

**22. Differentiate between primary and secondary air pollutants.**

(BWP-GII, LHR-GII, GUJ-GI, RWP-GI, II, MTN-GII)

Ans:

| Primary air Pollutants   | Secondary air Pollutants  |
|--|---|
| Primary air pollutants are the waste or exhaust products driven out because of combustion of fossil fuels and organic matter. These are oxides of sulphur ( $\text{SO}_2$ and $\text{SO}_3$ ), oxides of carbon ( $\text{CO}_2$ and $\text{CO}$ ), oxides of nitrogen (specially nitric oxide $\text{NO}$ ), hydrocarbon ( $\text{CH}_4$ ), ammonia and compounds of fluorine. | Secondary air pollutants are produced by various reactions of primary pollutants. These are sulphuric acid, carbonic acid, nitric acid, hydrofluoric acid, ozone and peroxy acetyl nitrate (PAN). |

**23. Define pollutants and air pollutants.**

(SGD-GI, MTN-GII, SWL-GII, GUJ-GI)

Ans: **Pollutants:** "A pollutant is a waste material that pollutes air, water and soil."

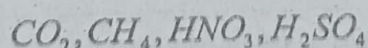
These pollutants are being created and discharged to the environment by human activities.

They make the environment (air, water or soil) harmful to life.

**Air Pollutants:** The harmful substances present in air are called air pollutants.

**24. Identify as primary and secondary pollutants.**

(SGD-I/II, DGK-II, SWL-II)



Ans:

| Primary air pollutants         | Secondary air pollutants                  |
|--------------------------------|---|
| $\text{CO}_2$<br>$\text{CH}_4$ | $\text{HNO}_3$<br>$\text{H}_2\text{SO}_4$ |

**25. What are secondary pollutants? Give an example.**

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: **Secondary pollutants:** Secondary pollutants are produced by various reactions of primary pollutants. These are sulphuric acid, carbonic acid, nitric acid, hydrofluoric acid, ozone and peroxy acetyl nitrate (PAN).



26.  $CO_2$  is responsible for heating up the atmosphere why?

(LHR-GI, GUJ-GII, RWP-GI, MTN-GI)

**Ans:** The  $CO_2$  forms a layer around the Earth like an envelope. It allows the heat rays of the sun to pass through it and reaches upto the earth. These rays are reflected from the earth surface and go back to upper atmosphere. Normal concentration of  $CO_2$  layer retains enough heat to keep the atmosphere warm. If there had been no  $CO_2$  layer, our earth would have been very cooled one and it would be very difficult for life to exist.

27. Give two effects of global warming.

(LHR-GII, BWP-GII, GUJ-GI, DGK-GII)

**Ans: Effects of Global Warming:**

- (i) Accumulation of carbon dioxide in air is resulting in increasing atmospheric temperature about  $0.05^\circ C$  every year.
- (ii) It is causing major changes in weather patterns. Extreme weather events are occurring more commonly and intensely than previously.

28. Define global warming.

(RWP-GII, MTN-GII, DGK-GII)

**Ans: Global Warming:** The average temperature of earth is rising due to combined increasing rate of green house effect and ozone depletion. Because of increased warming, this phenomenon is called global warming.

29. Why  $CO_2$  is called green house gas?

(LHR-GI, FSD-GI, II, DGK-GI, GUJ-GII)

**Ans:** Because  $CO_2$  in the atmosphere acts like a glass wall of a green house. It allows UV radiations to pass through it but does not allow the IR radiations to pass through it. Concentration of  $CO_2$  in air increases less heat energy, lost from the surface of the earth. Therefore the average temperature of the surface gradually increases. This is why  $CO_2$  is called green house gas.

30. Define green house effect and global warming.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans: Green House effect:** As the concentration of  $CO_2$  in air increases, less heat energy is lost from the surface of Earth. Therefore, the average temperature of the surface gradually increases. This is called green house effect.

**Global warming:** Green house effect is proportional to the amount of  $CO_2$  in air. Greater the amount of  $CO_2$  more is trapping of heat or warming. Due to increased warming the temperature of global is increasing this phenomenon is also called global warming.

## 14.4

### Acid Rain and Its Effects

31. How acid rain increases the acidity of soil? (RWP-GI, MTN-GII, LHR-GII, DGK-GI, SGD-GI)

**Ans:** Oxides of sulphur and nitrogen present in air when combine with rain water. They change into  $H_2SO_4$  and  $HNO_3$  and reaches to earth. This acidic rain increases the acidity of soil.

32. How acid rain affects the trees and plants? (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans: Effect on leaves of trees and plants:**

Acid rain directly damages the leaves of trees and plants, thus limiting their growth. Depending upon the severity of the damage, plants growth can be hampered. Plants ability to bear cold or diseases reduces and ultimately they died.

33. Write down any two effects of acid rain.

**Ans:** (i) Acid rain increases the acidity of the soil. Many crops and plants cannot grow properly in such soil. (ii) Acid rain directly damages the leaves of trees and plants.



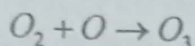
## 14.5

## Ozone Depletion and Its Effects

34. Where Ozone is found?

[FSD-II, DGK-I, SWL-II]

Ans. It is formed in atmosphere by the association of an oxygen atom with an oxygen molecule in the mid of stratosphere.



35. Give two serious effects of Ozone depletion. (GUJ-GI, MTN-GI, BWP-GI, II, LHR-GII, FSD-GI)

Ans. Effects of ozone depletion:

- (i) Depletion of ozone enables ultraviolet radiations of Sun to reach to the Earth, that can cause skin cancer to human beings and other animals.
- (ii) Decreased ozone layer will increase infectious diseases like malaria.

36. Why is Ozone important for humans?

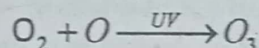
[DGK-II, SGD-I, BWP-I/II, SWL-I]

Ans. This layer surrounds the globe and protects earth like a shield from harmful ultraviolet radiations of sunlight. Otherwise, ultraviolet radiations would cause skin cancer. Thus ozone layer in stratosphere is beneficial for life on the Earth.

37. Define Ozone and Ozone Hole.

[RWP-II, DGK-I, SGD-II]

Ans. **Ozone:** Ozone is an allotropic form of oxygen consisting of three oxygen atoms.



**Ozone hole:** A single chlorine free radical released by the decomposition of CFCs is capable of destroying upto many lacs of ozone molecules. The region in which ozone layer depletes is called ozone hole.

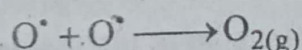
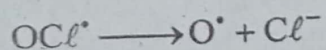
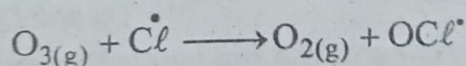
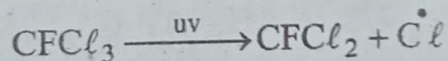
Signs of ozone depletion were first noticed over Antarctica in 1980s. Since 1990s depletion have also been recorded over the Arctic, as well.

38. How ozone layer is being depleted by chlorofluorocarbons ?

[LHR-II, SGD-II, MTN-I/II, DGK-I]

Ans. The ozone layer is being depleted through various chemical reactions, such as:

- (i) The ozone molecule absorbs solar radiation and dissociate readily, i.e, self dissociation of ozone takes place.
- (ii) However, chlorofluorocarbons' CFCs (used as refrigerants' in air conditions and refrigerators) are major cause of depletion of ozone layer. These compounds leak in one way or other, escape and diffuse to stratosphere. Their ultraviolet radiations break the C-Cl bond in and generates chlorine free radicals as.



## Solved Exercise

## Multiple Choice Questions

1. About 99% atmosphere's mass lies within:

(RWP-I)(ALP)

- (a) 30 kilometer (b) 35 kilometer (c) 15 kilometer (d) 11 kilometer

2. Depending upon temperature variation, atmosphere is divided into how many regions?

- (a) One (b) two (c) three (d) four



(DGK-II, MET-I, SRG-II, LHR-I)(ALP)

**3. Just above the Earth's surface is:**

- (a) mesosphere (b) stratosphere  
(c) thermosphere (d) troposphere

**4. A group of gases that maintains temperature of atmosphere is:**

- (a) carbon dioxide and water vapours (b) nitrogen and carbon dioxide  
(c) oxygen and water vapours (d) nitrogen and oxygen

**5. The Earth's atmosphere is getting hotter because of:**

(SWL-I)(ALP)

- (a) Increasing concentration of CO (b) Increasing concentration of CO<sub>2</sub>  
(c) Increasing concentration of CO<sub>3</sub> (d) Increasing concentration of SO<sub>2</sub>

**6. Which one of the following is not a Greenhouse effects?**

- (a) Increasing atmospheric temperature (b) Increasing food chains  
(c) Increasing flood risks (d) Increasing sea-level

**7. Normally rain water is weakly acidic because of:**

(RWP-II, BWP-I, SRG-II)(ALP)

- (a) SO<sub>3</sub> gas (b) CO<sub>2</sub> gas (c) SO<sub>2</sub> gas (d) NO<sub>2</sub> gas

**8. Buildings are being damaged by acid rain because it attacks:**

(SWL-I)(ALP)

- (a) calcium sulphate (b) calcium nitrate  
(c) calcium carbonate (d) calcium oxalate

**9. Acid rain affects the aquatic life by clogging fish gills because of:**

- (a) lead metal (b) chromium metal  
(c) mercury metal (d) aluminium metal

**10. Ozone is beneficial for us as it:**

(RWP-II)(ALP)

- (a) absorbs infra-red radiations (b) absorbs ultra-violet radiation  
(c) absorbs chlorofluorocarbons' (d) absorbs air pollutants

**11. Which one of the following is not an air pollutant?**

- (a) nitrogen (b) carbon dioxide  
(c) sulphur dioxide (d) ozone

**12. Iron and steel structures are damaged by:**

- (a) carbon monoxide (b) sulphur dioxide  
(c) methane (d) carbon dioxide

**13. Infra-red radiations emitted by the Earth are absorbed by:**

(RWP-I, MLT-II, GUJ-I, DGK-I/II)(ALP)

- (a) CO<sub>2</sub> and H<sub>2</sub>O (b) N<sub>2</sub> and O<sub>2</sub>  
(c) CO<sub>2</sub> and N<sub>2</sub> (d) O<sub>2</sub> and CO<sub>2</sub>

**14. Global warming causes rising of the sea level. The cause of global warming is:**

(MLT-II, FSD-I)(ALP)

- (a) CO<sub>2</sub> gas (b) SO<sub>2</sub> gas (c) NO<sub>x</sub> gases (d) O<sub>3</sub> gas

**15. Which gas protects the Earth's surface from ultraviolet radiations?**

(MLT-I, LHR-I, FSD-I)(ALP)

- (a) CO<sub>2</sub> (b) CO (c) N<sub>2</sub> (d) O<sub>3</sub>

**16. Effects of ozone depletion are following except the one:**

- (a) Increase infectious diseases (b) Increase crops production  
(c) can cause skin cancer (d) can cause climatic changes

**17. Which one of these pollutants are not found in car exhaust fumes?**

- (a) CO (b) O<sub>3</sub> (c) NO<sub>2</sub> (d) O<sub>2</sub>

**18. The process by which atmospheric nitrogen is turned into nitrates in the soil is called:**

- (a) nitrification (b) fixing (c) oxidation (d) reduction



## 19. Global warming is because of:

(BWP-II, GUJ-I)(ALP)

- (a) absorption of IR radiations emitted by the Earth's surface
- (b) absorption of IR radiations coming from the Sun
- (c) absorption of UV radiation coming from the Sun
- (d) emission of UV radiation from the Earth's surface

## 20. Carbon monoxide is harmful to us because:

- (a) It paralyses the lungs
- (b) It damages lungs tissues
- (c) It reduces oxygen carrying ability of haemoglobin
- (d) It makes the blood coagulate

## Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | a | 2  | d | 3  | d | 4  | a | 5  | b |
| 6  | b | 7  | b | 8  | c | 9  | d | 10 | b |
| 11 | a | 12 | b | 13 | a | 14 | a | 15 | d |
| 16 | b | 17 | b | 18 | b | 19 | a | 20 | c |

## Short Questions

## 1. Explain the phenomenon of decreasing temperature in troposphere.

**Ans.** Concentration of both carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ) vapours allows visible light to pass through but absorb infrared radiations emitted by the Earth's surface. Therefore, these gases absorb much of the outgoing radiations and warm the atmosphere. At altitude, the concentration of these gases decrease at a rate of  $6^\circ\text{C}$  per kilometer and decrease the temperature resultantly.

## 2. Differentiate between primary and secondary air pollutants.

**Ans. Primary pollutants:** Primary pollutants are the waste or exhaust products driven out because of combustion of fossil fuels and organic matter. These are oxides of sulphur ( $\text{SO}_2$  &  $\text{SO}_3$ ), oxides of carbon ( $\text{CO}$  and  $\text{CO}_2$ ), oxides of nitrogen (specially nitric oxide  $\text{NO}$ ); hydrocarbon  $\text{CH}_4$ ), ammonia and compounds of fluorine.

**Secondary pollutants:** Secondary pollutants are produced by various reactions of primary pollutants. These are sulphuric acid, carbonic acid; nitric acid, hydrofluoric acid, ozone and peroxy acetyl nitrate (PAN).

3. State the major sources of  $\text{CO}$  and  $\text{CO}_2$  emissions.

(RWP-I)(ALP)

**Ans. Source of oxides of carbon are as follows:**

- i. Volcanic eruption
- ii. Decomposition of organic matter
- iii. Combustion of fossil fuels
- iv. Forest fires
- v. Burning of wood

4.  $\text{CO}_2$  is responsible for heating up atmosphere, how?

**Ans.** Because  $\text{CO}_2$  in the atmosphere acts like a glass wall of a greenhouse, it traps some of the infrared radiations emitted by the earth and prevents heat energy escaping from the atmosphere. As the concentration of  $\text{CO}_2$  in air increases, less heat energy is lost from the surface of the Earth. Therefore, the average temperature of the surface gradually increases. This continuously average rise in temperature is called greenhouse effect. So it can be said that  $\text{CO}_2$  is responsible for heating up atmosphere.

## 5. CO is hidden enemy, explain its action.

**Ans.** CO is an air pollutant. It is a health hazard being highly poisonous gas. Being colourless and odourless, its presence can not be noticed easily and readily. When inhaled, it binds with the haemoglobin most strongly than that of oxygen. Thus, hindering the supply of oxygen in body. Exposure to higher concentration of CO causes headache and fatigue. If inhaled for a longer time it results in breathing difficulties.



6. What threats are there to human health due to  $SO_2$  gas as air pollutant?

Ans.  $SO_2$  is a colorless gas having irritating smell. It causes suffocation, irritation and severe respiratory problems to asthmatic people.

7. Which air pollutant is produced on anaerobic decomposition of organic matter?

Ans. Methane ( $CH_4$ ) comes from decomposition of organic matter under anaerobic (no oxygen) conditions.

8. How acid rain increases the acidity of soil?

(RWP-I, MLT-I, SWL-I, FSD-I)(ALP)

Ans. Oxides of sulphur and nitrogen present in air when combine with rain water. They change into  $H_2SO_4$  and  $HNO_3$  and reaches to earth. This acidic rain increases the acidity of soil.

9. Point out two serious effects of ozone depletion.

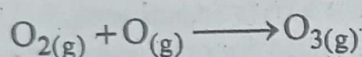
Ans. i. Depletion of ozone enables ultraviolet radiations of sun to reach to the Earth, that can cause skin cancer to human being and other animals.

ii. Decrease ozone layer will increase infectious diseases like malaria.

10. How ozone layer forms in stratosphere?

(MLT-I)(ALP)

Ans. The mid of stratosphere has ultra-violet light (UV) passing through it. Here O and  $O_2$  recombines to form ozone which is an exothermic reaction. Ozone formation in this region results in formation of ozone layer. Thus, ozone layer exists in mid stratosphere.



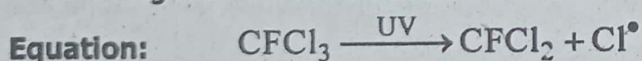
11. Why the 75% of the atmospheric mass lies within the troposphere?

Ans. Atmospheric pressure decreases regularly with the increase of altitude. As heavy gases lie close to the Earth surface, about 99% of the atmospheric mass lies within 30 kilometer of the Earth's surface. As troposphere extends upto 12km, so 75% of atmospheric mass lies within troposphere.

12. How ozone layer is being depleted by chlorofluocarbons?

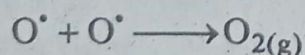
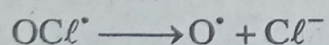
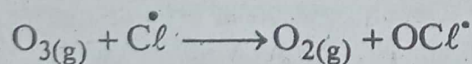
(MLT-II)(ALP)

Ans. Chlorofluorocarbons CFCs (used as refrigerants in air conditioners and refrigerators) are major cause of depletion of ozone layer. These compounds leak in one way or other, escape and diffuse to stratosphere. There ultraviolet radiations break the C-Cl bond in  $CFCl_3$  and generates chlorine free radical as:



These free radicals are very reactive. They react with ozone to form oxygen as.

Equation:



Which ultimately cause depletion in ozone layer.

### Extensive Questions

1. Define air pollutants write the types of pollutants in detail.

[RWP-GI-21][DGK-GI-21](ALP)

Ans. Air pollutants: "The harmful substances present in air are called air pollutants."

Even a beneficial substance beyond a specific concentration may be harmful. Air pollutants change the weather, badly affect the human health, damage the plants and destroy buildings.

Types of pollutants: i. Primary pollutants ii. Secondary pollutants



**Primary pollutants:** Primary pollutants are the waste or exhaust products driven out because of combustion of fossil fuels and organic matter. These are oxides of sulphur ( $\text{SO}_2$  and  $\text{SO}_3$ ); oxides of carbon ( $\text{CO}_2$  and  $\text{CO}$ ); oxides of nitrogen (specially nitric oxide  $\text{NO}$ ); hydrocarbon ( $\text{CH}_4$ ); ammonia and compounds of fluorine.

**Secondary pollutants:** Secondary pollutants are produced by various reactions of primary pollutants. These are sulphuric acid, carbonic acid, nitric acid, hydrofluoric acid, ozone and peroxy acetyl nitrate (PAN).

2. **Define acid rain and write effects of acid rain.**

[RWP-GII-21](ALP)

**Ans. Acid Rain:** The burning of fossil fuels produces oxides of sulphur and nitrogen in air. Rain water converts  $\text{SO}_2$  into  $\text{H}_2\text{SO}_4$  and  $\text{NO}_x$  to  $\text{HNO}_2$  and  $\text{HNO}_3$ . Thus, acid rain is formed on dissolving acidic air pollutants such as sulphur dioxide and nitrogen by rain water. Rain water on dissolving air pollutants (acids)

**Effect of Acid Rain:**

(i) **Effects on buildings:**

Acid rain attacks the calcium carbonate present in the marble and limestone of buildings and monuments. Thus, these buildings are getting dull and eroded day by day.

(ii) **Suffocation causes death of aquatic life.**

Acid rain on soil and rocks leaches heavy metals (Al, Hg, Pb, Cr, etc.) with it and discharges these metals into rivers and lakes. Especially high concentration of aluminium metal clogs the fish gills. It causes suffocation and ultimately death of fish.

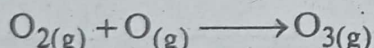
(iii) **Acidity of the soil:**

Acid rain increases the acidity of the soil. Many crops and plants cannot grow properly in such soil. It also increases the toxic metals in the soil that are poisonous to vegetation. Even old trees are being affected due to acidity of soil their growth is retarded. They get dry and die.

3. **How Ozone is formed? Write effects of ozone depletion.**

[MTN-GI-21](ALP)

**Ans:** Ozone is present throughout the atmosphere. But its maximum concentration is called ozone layer lies in stratosphere region about 25 to 30km away from the Earth's surface.



**Effects of ozone depletion:**

- (i) Depletion of ozone enables ultraviolet radiations of Sun to reach to the Earth, that can cause skin cancer to human beings and other animals.
- (ii) Decreased ozone layer will increase infectious diseases like malaria.
- (iii) It can change the life cycle of plants disrupting the food chain.
- (iv) It can change the wind patterns, resulting in climatic changes all over the world. Especially, Asia and Pacific will be most affected regions, facing climate-induced migration of people crises.

4. **Write the characteristics of Troposphere.**

[BWP-GI-21][MTN-GII-21](ALP)

**Ans. Composition of troposphere:**

The major constituents of troposphere are nitrogen and oxygen gases. These two gases comprise 99% by volume of the Earth's atmosphere:

Temperature range: (Decrease in temperature)

Although concentration of carbon dioxide and water vapours is negligible in atmosphere, yet they play a significant role in maintaining temperature of the atmosphere.

Both of these gases allow visible light to pass through but absorb infrared radiations emitted by the Earth's surface. Therefore, these gases absorb much of the outgoing radiations and warm the atmosphere. As the concentration of gases decreases gradually with the increase of altitude, correspondingly temperature also decrease at rate of  $6^\circ\text{C}$  per kilometer. This is the region where all weather occur. Almost all aircrafts fly in this region.



## Chapter

15

## Water

All Punjab Past Board Papers  
2014 - 2021

## ALP Annual Paper 2021

## MCQ's

1. Temporary hardness is because of:

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

(A)  $\text{Ca}(\text{HCO}_3)_2$ (B)  $\text{CaCO}_3$ (C)  $\text{MgCO}_3$ (D)  $\text{MgSO}_4$ 

2014 - 2020

## 15.1

## Properties of Water

2. Specific heat capacity of water is:

[GUJ-II, DGK-I, FSD-II, MTN-I, BWP-II]

(A)  $2.4 \text{ Jg}^{-1} \text{K}^{-1}$ (B)  $2.4 \text{ KJg}^{-1} \text{K}^{-1}$ (C)  $4.2 \text{ KJg}^{-1} \text{K}^{-1}$ (D)  $4.2 \text{ Jg}^{-1} \text{K}^{-1}$ 3. The density of water at  $4^\circ\text{C}$ .

[GUJ-I/II, RWP-IO, FSD-II]

(a)  $4 \text{ gcm}^{-3}$ (b)  $3 \text{ gcm}^{-3}$ (C)  $2 \text{ gcm}^{-3}$ (D)  $1 \text{ gcm}^{-3}$ 

4. How many percentage of world water contains oceans?

[RWP-II, GUJ-II, MTN-I, DGK-II, SWL-II]

(A) 67%

(B) 77%

(C) 87%

(D) 97%

5. Which percentage of the total water on the earth is potable?

[LHR-II, GUJ-I, RWP-II, FSD-I, BWP-II]

(A) 0.1

(B) 0.2

(C) 0.3

(D) 0.4

## 15.2

## Water as Solvent

6. The bond angle between H-O-H in water is:

(GUJ-GII, RWP-GII, DGK-II)

(A)  $104.5^\circ$ (B)  $104.6^\circ$ (C)  $104.7^\circ$ (D)  $104.8^\circ$ 

7. Water molecule has a structure:

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

(A) Ionic

(B) non polar

(C) Tetra hedral

(D) Polar

8. Ionic compounds are soluble in water due to:

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

(A) Ion-dipole forces

(B) Hydrogen bonding

(C) dipole-induced dipole forces

(D) dipole-dipole forces

9. Nature of water is:

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

(A) polar

(B) non-polar

(C) acidic

(D) basic

## 15.3

## Soft and Hard Water

10. Temporary hardness is removed by adding:

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

(A) quick lime

(B) slaked lime

(C) lime stone

(D) sodium chloride

11. Which one of the following ions is the cause of hardness of water?

(GUJ-GII, SGD-GI, DGK-GII)

(A)  $\text{Al}^{3+}$ (B)  $\text{Mg}^{2+}$ (C)  $\text{Fe}^{2+}$ (D)  $\text{Na}^+$



12. The removal of  $Mg^{+2}$  and  $Ca^{+2}$  ions which are responsible for the hardness of water is called: (SGD-I/II, DGK-II, SWL-II)  
 (A) temporary hardness (B) permanent hardness  
 (C) water softening (D) hydrogen bonding
13. The process of removing temporary hardness of water is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A) Clark's method (B) Washig soda method  
 (C) Sodium zeolite (D) Filtration method
14. Permanent hardness is removed by adding: (LHR-GI, RWP-GII, BWP-GI, SWL-GII)  
 (A) Sodium zeolite (B) Soda lime (C) Lime water (D) Quick lime
15. Which one of the following ions does not cause hardness in water: (LHR-GII, GUJG-II, RWP-GII)  
 (A)  $Ca^{2+}$  (B)  $Mg^{2+}$  (C)  $SO_4^{2-}$  (D)  $Na^+$
16. Which salt makes water permanently hard? (GUJ-GII, SWL-GII, RWP-GI, II, MTN-GI, DGK-GI, II)  
 (A)  $Na_2CO_3$  (B)  $NaHCO_3$  (C)  $Na_2CO_2$  (D)  $CaSO_4$
17. Permanent Hardness is because of: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A)  $Ca(HCO_3)_2$  (B)  $Mg(HCO_3)_2$  (C)  $NaCl$  (D)  $CaCl_2$
18. Chemical compound used in Clark's method is: (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)  
 (A)  $Ca(OH)_2$  (B)  $NaOH$  (C)  $HCl$  (D)  $CaO$

15.4

## Water Pollution

15.5

## Waterborne Infectious Diseases

19. Swimming pools are cleaned by a process: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A) Hydrogenation (B) Bromination (C) Chlorination (D) Nitration
20. Vibrios Cholerae bacteria cause the disease: (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)  
 (A) Typhoid (B) hepatitis (C) Dysentery (D) Cholera
21. Typhoid is a disease produced by \_\_\_\_\_: (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 (A) Virus (B) Algae (C) Fungus (D) Bacteria

## Answers

|    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | A | 2  | A | 3  | D | 4  | D | 5  | A | 6  | A | 7  | D | 8  | A | 9  | A | 10 | B |
| 11 | B | 12 | C | 13 | A | 14 | A | 15 | D | 16 | D | 17 | D | 18 | A | 19 | C | 20 | D |
| 21 | D |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |

## ALP Annual Paper 2021

## Short Questions

1. Why is water considered a universal solvent? (GUJ-GII, FSD-GI, II, BWP-GII, GUJ-GI, SGD-GI)

Ans: Water is the universal solvent because it can dissolve almost all the materials. Its ability to dissolve substances is because of its two unique properties:



(i) Polarity of water molecule.

(ii) Exceptional hydrogen bonding ability.

**2. Write two disadvantages of hard water.**

(LHR-GII, FSD-GI, GII, BWP-GII, SGD-GI, GII, MTN-GII)

**Ans: Disadvantages of Hard Water:**

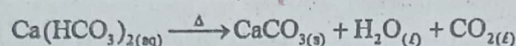
- (i) Hard water consumes large amount of soap in washing purposes.
- (ii) Drinking hard water causes stomach disorders.

**3. Define soft and hard water.**

(GUJ-GII, DGK-GI, II, MTN-GII, LHR-GII, SWL-GII, LHR-I)

**Ans.** Soft water is that which produces good lather with soap while hard water is that which does not produce lather with soap.**4. How is temporary hardness removed by Boiling of water?** (GUJ-GI, II, FSD-GI, SGD-GI)**Ans: By boiling:** Temporary hardness of water is easily removed by boiling water.

On boiling, calcium bicarbonate  $\text{Ca}(\text{HCO}_3)_2(\text{aq})$  decomposes to produce insoluble calcium carbonate, which precipitates out of the solution.

**Equation:****5. What is meant by water pollution?**

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans: Water Pollution:** Water pollution is a contamination of water bodies (e.g. lakes, rivers, oceans and ground water). Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.**6. State effects of water pollution.**

(SGD-II/II, DGK-II, SWL-II)

**Ans: Effects of Water pollution:**

- 1) It is hazardous to human health. Drinking polluted water can cause cholera, typhoid and diarrhea.
- 2) The use of polluted water is not only dangerous for people but also for animals and birds.
- 3) It is damaging aquatic life, thus breaking a link in food chain.

**7. Define industrial effluents.**

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans:** Discharge of wastes (chemicals and solid materials) either to open ground or to water channels is called industrial effluent. The industrial effluents may be highly toxic organic chemicals, inorganic salts, heavy metals, mineral acids, oil and greases etc.**8. What is fluorosis?**

(SWL-I, LHR-GII, FSD-GI, SGD-GI, II, RWP-GII, DGK-GII)

**Ans: Fluorosis:** Fluorosis is a disease caused by the consumption of excess fluoride. Fluorosis can cause bones and teeth damage.**9. What is meant by dysentery? How it caused?**

(RWP-I, DGK-II, SWL-II)

**Ans: Dysentery:** Dysentery is an intestinal disease which is typically caused by certain bacteria or parasites. It is characterized by severe diarrhea that may be accompanied by blood or mucus.**10. What is hepatitis?**

(GUJ-I)

**Ans:** The inflammation of liver is called hepatitis. It is commonly caused by viruses called A, B, C, D and E.**11. Which bacteria causes the Cholera?**

(GUJ-I)

**Ans:** *Vibrio cholerae* cause cholera.**12. What is the function of fertilizers?**

(MLT-II)

**Ans:** Fertilizer provide minerals and other nutrients to soil, which were used by crops after cultivation.



2014 - 2020

15.1

## Properties of Water

13. What do you know about the occurrence of water?

[GUJII,FSD-I,DGK-I/II]

**Ans. Occurrence of water:** The oceans contain about 97% of world water. The rest of the water is in the form of glaciers, ice caps, ground water and inland water (river, lakes, and streams). It is also present in atmosphere in the form of water vapours.

14. Write any four properties of water.

[GUJ-II,SGD-I,MTN-II,DGK-I/II,BWP-I]

**Ans. i. Nature:** Water is natural to litmus.

**ii. Freezing and boiling points:** Its freezing point is 0°C and boiling point is 100°C at sea level.

**iii. Maximum density:** Its maximum density is 1 gcm<sup>-3</sup> at 4°C.

**iv. Solvent:** Water is excellent solvent for ionic as well as molecular compounds.

15.2

## Water as Solvent

15. Ionic compounds are soluble in water. Explain why?

(SGD-I/II,DGK-II,SWL-II)

**Ans:** The electrostatic attractions among the ions are overcome by the ion-dipole forces of attraction between ion and water molecules. In this way, positive and negative ions of the compounds are pulled apart. Ultimately, these oppositely charged ions are surrounded by water molecules, thus separated and kept in solution. For example, most of the salts like NaCl, KCl, Na<sub>2</sub>SO<sub>4</sub> etc. are soluble in water.

16. Why the water molecule is polar?

(LHR-I/II,MUL-I,SGD-I,DGK-I/II,SWL-I/II)

**Ans:** Water molecule has polar structure. Its one end of the molecule is partially positive while the other end is partially negative because of electro negativity difference between oxygen and hydrogen atoms.

15.3

## Soft and Hard Water

17. What do you mean by boiler scales? How are they removed?

(RWP-GI,FSD-GII,SGD-GII,LHR-GII,SWL-GI)

**Ans: Boiler Scales:** If hard water is used in boiler, insoluble calcium and magnesium salts deposit inside it. They are called boiler scales. This problem can be overcome by treating hard water and converting it into soft water.

18. Define Scum and leaching Process.

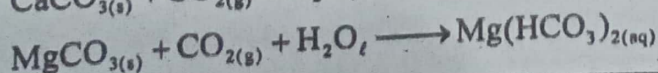
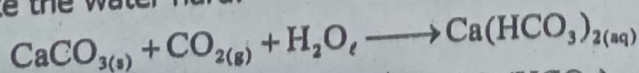
(LHR-II,GUJ-I/II,FSD-I,MUL-I/II,SGD-I/II,DGK-II,SWL-II)

**Ans: Scum:** Calcium and magnesium ions present in hard water react with soap to form an insoluble precipitate of calcium and magnesium salts of fatty acids called scum.

**leaching Process:** Intensive cultivation of crops causes chemicals from fertilizers and pesticides to seep into the ground water. It is commonly called leaching process.

19. What are the causes of hardness of water? (LHR-GI,RWP-GII,MTN-GI,BWP-GI,SWL-GI)

**Ans: Causes of Hardness of Water:** The rain water while coming down absorbs carbon dioxide from the atmosphere. The water mixed with carbon dioxide, when passes through the beds of soil, it converts insoluble carbonates of calcium and magnesium into soluble bicarbonates. It may also dissolve chlorides and sulphates of calcium and magnesium. These salts make the water hard.

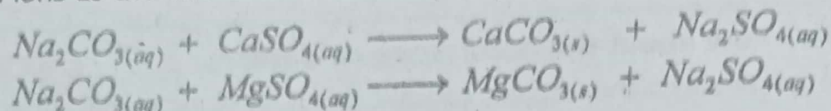




20. Give a method to remove permanent hardness of water.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: By using washing soda: The addition of washing soda removes the calcium and magnesium ions as the insoluble calcium and magnesium carbonates, respectively.



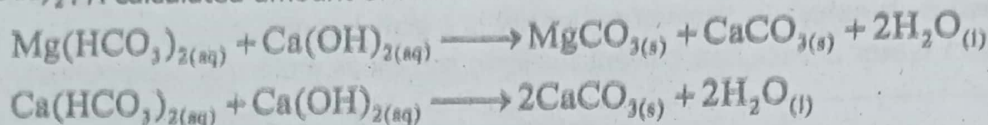
21. Explain the chemistry of removing hardness of water by Clark's method.

(LHR-GII, GUJ-GII, DGK-GI, SGD-GI, SWL-GI)

Ans: Clark's method:

A chemical method to remove temporary hardness is by the addition of slaked lime

$\text{Ca}(\text{OH})_2$ . A calculated amount of lime water is added to temporary hard water.



22. How Sodium Zeolite softens water?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Sodium zeolite is naturally occurring resin of sodium aluminium silicate  $\text{NaAl}(\text{SiO}_3)_2$ , which can also be prepared artificially. It is used for softening of water on domestic as well as on industrial scale. When water is passed through resin, sodium ions of the resin are exchanged with the unwanted calcium and magnesium ions of the hard water.



23. Describe briefly the two types of Hardness of Water.

(BWP-GII, RWP-GII, FSD-GII)

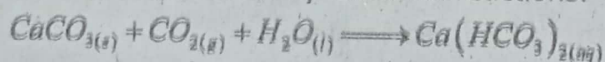
Ans: Hardness is of two types:

- (i) **Temporary hardness:** Temporary hardness is because of the presence of bicarbonates of calcium and magnesium.
- (ii) **Permanent hardness:** Permanent hardness is because of the presence of sulphates and chlorides of calcium and magnesium.

24. How does lime stone dissolve in water?

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: While coming down the rain water absorbs  $\text{CO}_2$  from the atmosphere. When this water passes through the bed of the soils, converts insoluble carbonates of calcium lime stone into soluble bicarbonates which is shown by chemical reactions.



## 15.4

## Water Pollution

25. What is leaching process?

(FSD-GII, BWP-GI, MTN-GII)

Ans: **Leaching Process:** The process in which chemicals from fertilizers and pesticides seep into ground water as a result of intensive cultivation of crops is called leaching process. The high nitrate contents in ground water is mainly because of irrigation run-off from agricultural fields.

26. State disadvantages of detergents.

(LHR-I, MTN-GII, GUJ-GII, SGD-GI, BWP-GI)

Ans: **Disadvantages of Detergents:**

- (i) Some of detergents are non-biodegradable. When household water containing these detergents is discharged in streams, ponds, lakes and rivers, it causes water pollution.
- (ii) The detergents remain in water for a long time and make the water unfit for aquatic life.



27. What is the difference between Biodegradable and Non-Biodegradable Substances?

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans:

| Non-Biodegradable Substances   | Biodegradable Substances  |
|--|---|
| (i) The substances which cannot be decomposed by microorganisms like bacteria are called non-biodegradable substances.<br><b>Example:</b> Detergents | (i) The substances which can be decomposed by microorganisms like bacteria are called biodegradable substances.<br><b>Example:</b> Soap, Decaying plants and animals. |

28. What is an industrial waste?

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans: Industrial waste:** The industrial waste is the waste material of industries which is thrown into rivers or open ground. It includes highly toxic organic chemicals, inorganic salts, heavy metals, mineral acid, oil and greases etc.

29. How detergents cause depletion of oxygen in water?

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** The phosphate salts present in detergents causes rapid growth of algae in water bodies, which floats over the surface of water. These plants ultimately die and decay. Decaying plants being biodegradable consume oxygen gas present in water. Thus, depletion of oxygen gas occurs.

## 15.5

### Waterborne Infectious Diseases

30. What is jaundice? Give its symptoms.

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans: Jaundice:** Jaundice is caused by an excess of bile pigments in the blood.

**Symptoms of jaundice:** 1) Liver ceases to function and eyes turn yellow.

2) Patients feel weakness and fatigue.

31. Write about cryptosporidium.

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** Water borne micro-organism (Protozoa) that causes gastro intestinal illness (cryptosporidiosis) including diarrhea and vomiting. These tiny pathogens are found in surface water sources like reservoirs, lakes and rivers.

32. What is difference between hepatitis and jaundice?

(SGD-I/II, DGK-II, SWL-II)

**Ans: Difference between Hepatitis and Jaundice:**

**Hepatitis:** The liver's inflammation is called Hepatitis. This is produced by the effect of five viruses like A, B, C, D and E. Hepatitis A and E is due to polluted water.

**Jaundice:** Jaundice is caused by an excess of bile pigments in the blood. Liver ceases to function and eyes turn yellow. Patient feels weakness and fatigue.

33. What are water borne diseases?

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans: Water borne diseases:**

Diseases that spread because of drinking polluted water or eating food prepared with polluted water are called water borne infectious diseases.

34. What are dysentery and typhoid?

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans: Dysentery:** Dysentery is an intestinal disease which is typically caused by certain bacteria of parasites.

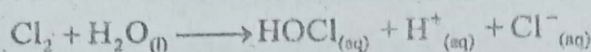
**Typhoid:** A dangerous bacterial disease often spread by contaminated water or by food prepared with contaminated water.



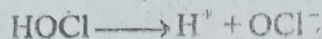
**35. What do you mean by chlorination?**

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans.** Addition of chlorine solution in water is called chlorination. Chlorine kills bacteria and other micro organisms.  $\text{Cl}_2$  itself does not kill rather it dissociates in water to form hypochlorous acid (HOCl) and hydrochloric acid.



HOCl further ionizes to produce hypochlorite and proton.



Both these kill bacteria and microorganism.

**36. What is the reason of jaundice and typhoid?** (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans: Cause of Jaundice:** It is caused by an excess of bile pigments in the blood. Liver ceases to function and eyes turn yellow.

**Cause of Typhoid:** It is caused due to contaminated water or by food prepared with contaminated water.

## Solved Exercise

### Multiple Choice Questions

- Which one of the following properties of water is responsible for rising of water in plants?**
  - Specific heat capacity
  - Surface tension
  - Excellent solvent action
  - Capillary action
- Specific heat capacity of water is.**
  - $4.2 \text{ KJg}^{-1}\text{k}^{-1}$
  - $4.2 \text{ Jg}^{-1}\text{k}^{-1}$
  - $2.4 \text{ K Jg}^{-1}\text{k}^{-1}$
  - $2.4 \text{ Jg}^{-1}\text{k}^{-1}$
- Water dissolves non-ionic compound by.** (LHR-I)
  - Ion-ion forces
  - Ion-dipole forces
  - Dipole-dipole force
  - Hydrogen bonding
- Temporary hardness is because of.**
  - $\text{Ca}(\text{HCO}_3)_2$
  - $\text{CaCO}_3$
  - $\text{MgCO}_3$
  - $\text{MgSO}_4$
- Temporary hardness is removed by adding.**
  - Quick
  - Slaked lime
  - Lime water
  - Lime stone
- Permanent hardness is removed by adding.**
  - $\text{Na}_2$  zeolite
  - Soda lime
  - Lime water
  - Quick lime
- Which one of the following salts makes the water Permanently hard?**
  - $\text{Na}_2\text{CO}_3$
  - $\text{NaHCO}_3$
  - $\text{Ca}(\text{HCO}_3)_2$
  - $\text{CaSO}_4$
- Rapid growth of algae in water bodies is because of detergent having.** (RWP-I, DGK-I)(ALP)
  - Carbonate salts
  - Sulphonic acid salts
  - Sulphate salts
  - Phosphate salts
- Depletion of  $\text{O}_2$  from water is not because of.**
  - Decaying of aquatic plants
  - Biodegradation of aquatic plants
  - Rapid growth of aquatic plants
  - Decomposition of aquatic plants
- Which one of the following diseases causes liver inflammation.** (SRG-II, SWL-I, MLT-I, FSD-I)(ALP)
  - Typhoid
  - Jaundice
  - Cholera
  - Hepatitis
- Which one of the following diseases causes severe diarrhea and can be fatal?** (MLT-II)(ALP)
  - Jaundice
  - Dysentery
  - Cholera
  - Typhoid



12. Which one of the following gases is to destroy harmful bacteria in water? (GUJ-I, RWP-II)(ALP)  
 (a) Iodine (b) Chlorine (c) Fluorine (d) Bromine
13. Which one of the following ions does not cause hardness in water?  
 (a)  $\text{Ca}^{2+}$  (b)  $\text{Mg}^{2+}$  (c)  $\text{SO}_4^{2-}$  (d)  $\text{Na}^+$
14. A disease that causes bone and tooth damage is.  
 (a) Fluorosis (b) Hepatitis (c) Cholera (d) Jaundice
15. Ionic compounds are soluble in water due to. (BWP-II, DGK-II)(ALP)  
 (a) Hydrogen bonding (b) Ion-dipole forces  
 (c) Dipole-dipole forces (d) Dipole-induced
16. The chemicals used to kill or control pests are called pesticides. They are:  
 (a) Dangerous inorganic chemicals (b) Dangerous organic chemical  
 (c) Beneficial inorganic chemicals (d) Beneficial organic chemicals

### Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | d | 2  | b | 3  | D | 4  | a | 5  | b |
| 6  | a | 7  | d | 8  | d | 9  | c | 10 | d |
| 11 | c | 12 | b | 13 | d | 14 | a | 15 | b |
| 16 | b |    |   |    |   |    |   |    |   |

### Short Questions

1. How water rises in plants?

Ans. Water rises in plants by capillary action. It is the process by which water rises up from the roots of plants to leaves.

2. Which forces are responsible for dissolving polar substances in water?

(MLT-II, DGK-I/II)(ALP)

Ans. Dipole-Dipole forces are responsible for dissolving polar substances in water. Positive end of polar substance is attracted by negative end of water while negative end of polar substance is attracted by positive end of water molecule.

3. Why non-polar compounds are insoluble in water?

(MLT-I, FSD-I)(ALP)

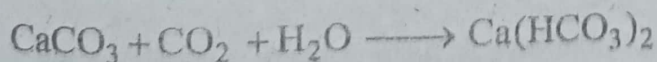
Ans. Non polar compounds are those compounds which have covalent bonds with polar ends. So, non polar bonds are not attracted by water molecule as water is polar molecule.

4. How water dissolves sugar and alcohols?

Ans. Sugar and alcohol have polar end, i.e.  $\text{O}^{\delta-} - \text{H}^{\delta+}$  group. These substances are soluble in water due to hydrogen bonding.

5. How lime stone dissolves in water?

Ans. Lime stone dissolves in water when  $\text{CO}_2$  is passed through it.



6. Differentiate between soft and hard water.

Ans. **Soft water:** It is the water which produces good leather with soap.

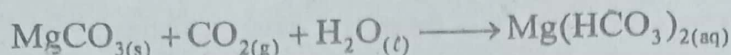
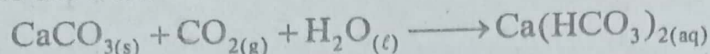
**Hard Water:** It is the water which does not produce good leather with soap.

7. What are the causes of hardness in water?

Ans. **Causes of hardness in water:** The rain while coming down absorbs carbon dioxide from the atmosphere. The water mixed with carbon dioxide, when passes through the beds of the soil, converts insoluble carbonates of calcium and magnesium into soluble bicarbonates.



It may also dissolve chlorides and sulphates of calcium and magnesium. These salts make the water hard.



**8. What are the effects of temporary hardness in water?**

- Ans.** (i) It causes stomach disorder  
(ii) Insoluble calcium and magnesium carbonates form scales which reduces the efficiency of engine and boilers burst up.

**9. Mention the disadvantages of detergents.**

- Ans.** (i) It makes water unfit for aquatic life.  
(ii) The phosphates salts present in detergents causes rapid growth of algae that is ultimately risky for aquatic life with respect to its decay purpose and consumption of oxygen.

**10. What is difference between biodegradable and non-biodegradable substances?**

**Ans.**

| Biodegradable Substances  | Non-biodegradable substances   |
|---|--|
| The substances which can be decomposed by bacteria and fungi are called biodegradable substances. | The substances which cannot be decomposed by bacteria are called non biodegradable substances. |
| <b>Example:</b> Decaying plants and animals.  | <b>Example:</b> detergents   |

**11. How detergents make the water unfit for aquatic life?** (DGK-II)(ALP)

**Ans.** Phosphate salts present in detergents cause rapid growth of algae. The plants, die and decay. Decaying plants consume oxygen in water. Thus deficiency of oxygen leads to death of aquatic life.

**12. Why pesticides are used?** (GUJ-I)(ALP)

**Ans.** Because they kill or control the growth of pests. Pests may be weeds, herbs, fungi and viruses.

**13. What are the reason of waterborne diseases?** (DGK-I)(ALP)

**Ans. Reasons behind waterborne diseases are as follows:**

- Drinking polluted water
- Eating food prepared with polluted water
- Presence of micro organisms in water
- Lack of proper sanitation arrangement

**14. How waterborne diseases can be prevented?** (GUJ-I)(ALP)

**Ans. Waterborne diseases can be prevented by:**

- Provision of safe water
- Disposal of sewage
- Control of toxic chemicals.
- Proper sanitation

### Extensive Questions

**1. Write four effects of water pollution.** [RWP-GII-21](ALP)

**Ans: Effects of water pollutants:**

- Hazardous to human health:** Water pollution is hazardous to human health. Drinking polluted water can cause cholera, typhoid and diarrhea.
- Hazardous to animals and birds:** The use of polluted water is not only devastating people but also for animals and birds.
- Damage food chain:**  
Water pollution is damaging aquatic life, thus breaking a link in food chain.
- Reduce aesthetic quality:**  
Water pollution reduces the aesthetic quality of lakes and rivers.



2. Write a note any four waterborne diseases.

[SGD-GII-21][RWP-GI-21][SWL-21](ALP)

**Ans. Waterborne diseases:** Diseases that spread because of drinking polluted water or eating food prepared with polluted water are called waterborne infectious diseases.

- (i) **Diarrheal diseases:** Intestinal disease, such as cholera, that may cause dangerous dehydration. Diarrhea may be caused by viruses, bacteria or parasites.
- (ii) **Dysentery:** Dysentery is an intestinal disease which is typically caused by certain bacterial of parasites.

**Symptoms:** It is characterized by severe diarrhea that may be accompanied by blood and mucous.

- (iii) **Cholera:** Cholera is an acute infection.

**Causative agent:** It is caused by the bacteria *Vibrios cholera*, which may be found in water contaminated by human faeces.

**Symptoms:** Cholera causes severe diarrhea and can be fatal.

- (vi) **Hepatitis:** It is liver inflammation commonly caused by one of five viruses called hepatitis A, B, C, D and E. Transmission of hepatitis A and E. Hepatitis A and E can be transmitted by contaminated water.

3. Write any four properties of water.

[DGK-GI-21](ALP)

**Ans. Properties of water:**

Water is composed of two elements: oxygen and hydrogen. One atom of oxygen combines with two atoms of hydrogen to form one molecule of water. : Pure water is a clear, colorless, odourless and tasteless liquid with following properties:

- i. Water is neutral to litmus.

- ii. **Freezing and boiling points:**

Its freezing point is  $0^{\circ}\text{C}$  and boiling point is  $100^{\circ}\text{C}$  at sea level.

- iii. **Maximum density:** Its maximum density is  $1\text{ gcm}^{-3}$  at  $4^{\circ}\text{C}$ .

- iv. **Solvent:** Water is excellent solvent for ionic as well as molecular compounds.

- v. **Heat capacity:** Water has unusually high heat capacity about  $4.2\text{ Jg}^{-1}\text{ K}^{-1}$ , which is about six times greater than that of rocks.

4. Define hard water. Give disadvantages of hard water.

[MTN-GI-21](ALP)

**Ans: Hard Water:** Hard water is that which does not produce lather with soap.

**Disadvantages of hard water:**

- (i) Hard water consumes large amount of soap in washing purposes.
- (ii) Drinking hard water causes stomach disorders.
- (iii) Hard water is unfit for use in steam engines, boilers and turbines.

5. Explain Domestic Effluents.

[BWP-GI-21](ALP)

**Ans. Major cause of domestic effluents:** Use of detergents is increasing day by day for cleaning purposes in houses and industries.

Detergents have a major disadvantage over the soaps, as some of the detergents are non-biodegradable (cannot be decomposed by micro-organisms like bacteria).

Water pollution by detergents: When household water containing detergents is discharged in streams, ponds, lakes and rivers, it causes water pollution.

**Effect on aquatic life:**

The detergent remains in the water for a long time and makes the water unfit for aquatic life. The phosphate in detergents causes rapid growth of algae in water bodies, which floats over the surface of water.

These plants ultimately die and decay. Decaying plants being bio-degradable consume oxygen gas present in water. Thus, depletion of oxygen gas results in death of aquatic life.

**Domestic sewage:**

Domestic sewage contains a wide variety of dissolved and suspended impurities.

**Composition of domestic sewage:**

They include food and vegetable waste, garbage, cans, bottles, chemical soaps, washing powder, etc. It also contains disease causing microbes. All these substances add to water pollution.



## Chapter 16

## Chemical Industries

All Punjab Past Board Papers  
2014 - 2021

## ALP Annual Paper 2021

## MCQ's

1. The chemical formula of chalcopryrite is: (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)  
 (A)  $Cu_2S$  (B)  $CuFeS_2$  (C)  $CuS$  (D)  $FeS$  (BWP-II)
2. About 90% urea is used in:  
 (A) Fertilizer (B) Explosives (C) Automobile (D) None

## 2014 - 2020

## 16.1

## Basic Metallurgical Operations

3. The impurities associated with the minerals are known as:  
 (A) metallurgy (B) ores (C) gangue (D) compounds (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)
4. Chalco-pyrite is an ore of:  
 (A) Copper (B) Silver (C) Iron (D) Aluminium (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)
5. Which is the slag of Copper metallurgy?  
 (A)  $SiO_2$  (B)  $FeSiO_3$  (C)  $CaO$  (D)  $CaSiO_3$  (SGD-I/II, DGK-II, SWL-II)

## 16.2

## Manufacture of Sodium Carbonate by Solvay's Process

6. In the lime kiln the reaction goes to completion because of:  
 (A)  $CaO$  is more stable than  $CaCO_3$  (B)  $CaO$  is not dissociated  
 (C) Low temperature (D)  $CO_2$  escapes continuously (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)
7. Ammonia is prepared by:  
 (A) Solvay's process (B) Haber's process  
 (C) Flotation process (D) Bayer's process (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)
8. Formation process of Ammonia by the combination of Hydrogen and Nitrogen was given by:  
 (A) Dalton (B) Thomson (C) Haber (D) Waag (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

## 16.3

## Manufacture of Urea

9. Percentage of nitrogen in urea is:  
 (A) 76.6% (B) 66.6% (C) 56.6% (D) 46.6% (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)
10. The nitrogen present in urea is used by plants to synthesize:  
 (A) Sugar (B) Proteins (C) Fats (D) DNA (LHR-GII, BWP-GII, RWP-GI)
11. In Haber's process the catalyst used is:  
 (A) nickel (B) platinum (C) cadmium (D) Iron (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)
12. The gas prepared by Haber's process is:  
 (A)  $CO_2$  (B)  $SO_2$  (C)  $HI$  (D)  $NH_3$  (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)



16.4

## Petroleum Industry

13. Which one of the following is not a fraction of petroleum? [GUJ-I, FSD-II, MTN-I, BWP-II]  
 (A) Kerosene oil (B) Diesel Oil (C) Alcohol (D) Petrol
14. Fuel oil contains carbon: [SGD-I, MTN-I/II, BWP-I, SWL-II]  
 (A)  $C_7 - C_{10}$  (B)  $C_{10} - C_{12}$  (C)  $C_{15} - C_{18}$  (D) all these
15. The crude oil is heated in a furnace upto temperature: [RWP-II, DGK-I, GUJ-II, BWP-II]  
 (A)  $300^\circ\text{C}$  (B)  $400^\circ\text{C}$  (C)  $500^\circ\text{C}$  (D)  $600^\circ\text{C}$
16. In Diesel oil, the carbon composition is: [LHR-II, GUJ-II, RWP-I, FSD-II, SWL-II]  
 (A)  $C_7$  to  $C_{10}$  (B)  $C_{10}$  to  $C_{12}$  (C)  $C_{13}$  to  $C_{15}$  (D)  $C_{15}$  to  $C_{18}$

## Answers

|    |   |    |   |    |   |    |   |    |   |    |   |   |   |   |   |   |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|---|---|---|---|---|---|----|---|
| 1  | B | 2  | A | 3  | C | 4  | A | 5  | B | 6  | D | 7 | B | 8 | C | 9 | D | 10 | B |
| 11 | D | 12 | D | 13 | C | 14 | C | 15 | B | 16 | C |   |   |   |   |   |   |    |   |

## ALP Annual Paper 2021

## Short Questions

1. Define metallurgy. (LHR-GII, RWP-GI, II, DGK-GI, FSD-GI, II, BWP-GI, II)  
 Ans: **Metallurgy:** The process of extraction of a metal in a pure state on a large scale from its ore by physical or chemical means is called metallurgy.
2. Define minerals. (SWL-GII, GUJ-GI, SGD-GII, DGK-GII)  
 Ans: **Minerals:** The solid natural materials found beneath the Earth's surface which contains compounds of metals in the combined state along with earthly impurities, are called minerals.
3. Write electromagnetic separation process. (SWL-GI, GUJ-GI, RWP-GI, DGK-GI)  
 Ans: Electromagnetic separation is based on the separation of magnetic ores from the non-magnetic impurities by means of electromagnets or magnetic separators. The powdered ore is dropped over a leather belt moving over two rollers, one of which is magnetic. The non-magnetic ore falls first and the magnetic ore gets attracted and falls farther away.
4. Write a short note on gravity separation in metallurgy. SGD-GI, GII, MTN-GI, GUJ-GI, GUJ-GI  
 Ans: **Gravity separation:** Gravity separation is based on the differences in densities of the metallic ore and the gangue particles. In the process the powdered heavy metal bearing ore settles down on agitation in a stream of water, while lighter gangue particles are carried away.
5. Define ores. Write names of any two ores of copper. (LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 Ans: **Ore:** Those minerals from which the metals are extracted with commercial minimum efforts are called ores of the metals. For example Copper glance ( $\text{Cu}_2\text{S}$ ) Chalcopyrite ( $\text{CuFeS}_2$ ).
6. What is blister copper? (GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)  
 Ans: **Blister Copper:** The dissolved gases escape out forming blisters on the surface of the solid copper. Therefore, it is called blister copper. It is about 98% pure copper.
7. Give Formulae of chalcopyrite and copper glance. (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: Formula of chalcopyrite:  $\text{CuFeS}_2$

Formula of copper glance:  $\text{Cu}_2\text{S}$



**8. Which raw materials are required in Solvay's process?**

(GUJ-GII, DGK-GI, SWL-GI, LHR-GI, RWP-GII)

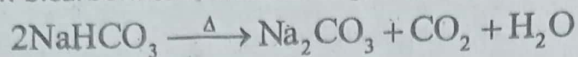
**Ans: Raw Materials:** The raw materials needed for this process are cheap and easily available. They are in abundance, such as,

- (i) Sodium chloride (NaCl) or brine. (ii) Limestone ( $\text{CaCO}_3$ ),  
(iii) Ammonia gas ( $\text{NH}_3$ ).

**9. Give the process of calcination in Solvay's process.**

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans: Calcination:** Sodium bicarbonate is heated to give sodium carbonate.

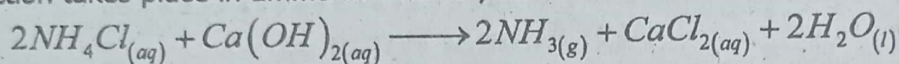


$\text{CO}_2$  is again used in tower.

**10. How ammonia is recovered in the Solvay's process?**

(LHR-GI, SGD-GII, BWP-GI, GUJ-GI, DGK-GI)

**Ans:** Ammonia is recovered by the reaction of ammonium chloride and calcium hydroxide in ammonia recovery tower. Only the residue will be calcium chloride. The reaction takes place in ammonia recovery tower.



**11. Describe the process of granulation of urea.**

(SGD-GI, RWP-GI, FSD-GII, DGK-GI)

**Ans: Granulation of Urea:** After urea formation, the liquid urea is evaporated to form granules. When liquid urea is sprayed from top of a tower under pressure and a hot current of air is introduced from the base, it evaporates to form granules. Then this is stored to be marketed.

**12. Which raw materials are used in the preparation of urea?**

(DGK-GI, BWP-GII, RWP-GII, GUJ-GII, MTN-GI)

**Ans:** Raw materials used for manufacturing urea are:

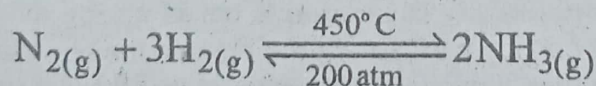
- (i) Ammonia ( $\text{NH}_3$ ) (ii) Carbon dioxide ( $\text{CO}_2$ )

**13. How is ammonia prepared for the Synthesis of urea?**

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**Ans:** Ammonia is prepared by the "Haber's process". One volume of nitrogen (from air) and three volumes of hydrogen (obtained by passing methane and steam over heated nickel catalyst) is passed over iron catalyst at  $450^\circ\text{C}$  and 200 atm pressure.

**Equation:**



**14. Write two important uses of urea.**

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans: Importance of urea:**

- (i) Urea is widely used world over in agriculture sector both as a fertilizer and animal feed additive.  
(ii) Urea is used as raw materials for many important compounds.

**15. What are natural fertilizers?**

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans:** Fertilizer is a substance added to soil to improve plants' growth and yield.

Natural Fertilizers contain all natural biodegradable materials are decomposed by bacteria. Decomposed materials contain useful nutrient for plants. Organic matter is essential part of fertile soil. Uses of natural fertilizers return the nutrients and organic matter of soil.

**16. What is froth flotation process?**

(BWP-I)

**Ans:** Froth flotation process is based on the wetting characteristic of the ore and the gangue particles with oil and water, respectively. The ore particles are preferentially wetted by oil



and the gangue particles by water. The whole mixture is agitated with compressed air. Hence, oil coated ore particles being lighter come to the surface in the form of froth that can be skimmed.

17. Define gangue.

Ans: The earthly and other impurities associated with the minerals are known as gangue. (GUJ-I)(DGK-II)

2014 - 2020

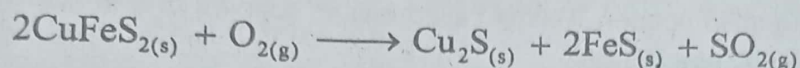
16.1

Basic Metallurgical Operations

18. Complete and balance the given equation:  $2\text{CuFeS}_{2(s)} + \text{O}_{2(g)} \longrightarrow$

[FSD-II, RWP-I, DGK-II, SGD-I/II, BWP-III]

Ans:



19. Explain the process of electro-refining.

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: **Electro-refining Process:** Most widely used process of refining metal is through electrolysis. For example, electro-refining of copper is done in electrolytic tank that has copper sulphate electrolytic solution along with two metal-electrodes. (impure copper metal as anode and pure copper metal as cathode).

On passing electric current through solution, anode (impure copper) dissolves to provide  $\text{Cu}^{2+}$  ions to solution. These copper ions deposit on cathode through reduction process, making it thick block of pure copper metal. The impurities like gold and silver settle down as anode mud.

20. What is difference between minerals and ores?

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans:

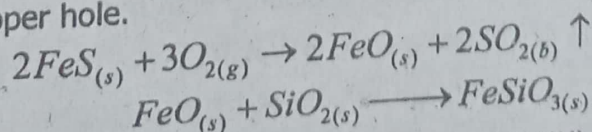
| Minerals  | Ores   |
|---|--|
| The solid natural materials found beneath the Earth's surface, which contains compounds of metals in the combined state along with earthly impurities, are called minerals. | Those minerals from which the metals are extracted commercially at a comparatively low cost with minimum efforts are called ores of the metals. For example: ores of copper are; copper glance $\text{Cu}_2\text{S}$ and chalcopyrite $\text{CuFeS}_2$ . |

(BWP-GII, SWL-GII, SWL-GII, RWP-GI)

21. What is smelting?

Ans: **Smelting Process:**

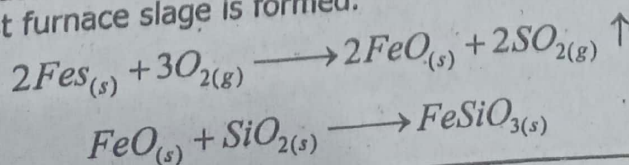
It is heating of the roasted ore with sand flux and coke in the presence of excess of air in a blast furnace. It is highly exothermic process, therefore, a small amount of coke is required in the process. In the process, first ferrous sulphide oxidizes to form ferrous oxide which reacts with sand to form iron silicate slag ( $\text{FeSiO}_3$ ). It being lighter rises to the top and is removed from the upper hole.



(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

22. How slag is formed in smelting process?

Ans: In smelting, the roasted ore is further heated with sand flux and coke in the presence of excess of air in blast furnace slag is formed.





**23. Define gangue and metallurgy.**

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans: Gangue:** The earthly and other impurities associated with the minerals are known as gangue.

**Metallurgy:** The process of extraction of a metal in a pure state on a large scale from its ore by physical or chemical means is called metallurgy.

**24. Define anode mud and blister copper.**

(FSD-GII, GUJ-GII, MTN-GI, GUJ-GI)

**Ans: Anode Mud:** In the refining of metal process, impure copper from the anode dissolves and goes into copper sulphate solution. Side by side, pure copper ions from the solution deposit on the cathode. Thus, cathode becomes a pure copper metal. The impurities like gold and silver settle down as anode mud.

**Blister Copper:** In Bessemerization the molten copper is shifted from the converter to the sand moulds and is allowed to cool. The dissolved gases escape out forming blisters on the surface of the solid copper. This is called blister copper. It is about 98% pure copper. It is further refined by electrolysis.

**25. What is meant by Bessemerization?**

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans: Bessemerization:** Bessemerization is the further heating of the molten matte in a pear shaped Bessemer converter or furnace.

**26. What is difference between slag and matte?**

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

**Ans:**

| Slag   | Matte  |
|--|--|
| (i) Slag is a mixture of metal silicates and phosphates.   | (i) Matte is a molten mixture of cuprous sulphide and ferrous sulphide ( $\text{Cu}_2\text{S} \cdot \text{FeS}$ ).                 |
| (ii) Slag being lighter in blast furnace rises to top and is removed from upper hole. $\text{FeSiO}_3$ | (ii) Matte being heavier in blast furnace forms lower layer and is removed from lower hole. $\text{Cu}_2\text{S} \cdot \text{FeS}$ |

**27. Write the formulae of:**

(GUJ-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

**a) Copper pyrite b) Matte**

**Ans. (a)** Copper Pyrite  $\text{CuFeS}_2$  **(b)** Matte  $\text{Cu}_2\text{S} \cdot \text{FeS}$

**28. Define Ore and write the name of an ore of copper.**

(SGD-I/II, DGK-II, SWL-II)

**Ans.** Those minerals from which the metals are extracted commercially at a comparative low cost with minimum effort are called ores of the metals. For example: ores of copper are; copper glance ( $\text{Cu}_2\text{S}$ ) and chalcopyrite ( $\text{CuFeS}_2$ ).

**29. Define minerals and gangue.**

(LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

**Ans. Minerals:** The solid natural materials found beneath the Earth's surface, which contains compounds of metals in the combined state along with earthly impurities, are called minerals.

**Gangue:** The earthly and other impurities associated with the minerals are known as gangue.

**Formula:** Chemical formula of copper glance is  $\text{Cu}_2\text{S}$ .

**30. What is meant by anode mud?**

(LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

**Ans. Anode Mud:** In electro-refining process of copper, anode (impure copper) dissolves to provide  $\text{Cu}^{2+}$  ions to solution. These copper ions deposit on cathode through reduction process, making it thick block of pure copper metal. The impurities which settle down at end of electro-refining process in electrolytic tank are called anode mud.

**For example:** Accumulation of silver and gold impurities at bottom in electro-refining process of copper.



31. Why a small amount of coke is used in smelting process?

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: It is highly exothermic process as a large quantity of heat is released during smelting process, therefore a small amount of coke is used in smelting process.

32. How are slag and matte removed from the blast furnace.

(GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: **Removal of slag:** Slag being lighter in blast furnace rises to top and is removed from upper hole.

**Removal of matte:** Matte being heavier in blast furnace is removed from lower hole.

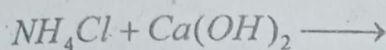
## 16.2

### Manufacture of Sodium Carbonate by Solvay's Process

33. How ammonical brine is prepared? (LHR-I/II, GUJ-I/II, FSD-I/II, MUL-I, SGD-II, DGK-I, SWL-I)

Ans: **Preparation of Ammonical Brine:** Ammonical brine is prepared by dissolving ammonia gas in sodium chloride solution (brine).

34. Complete and balance the chemical equation given below.



(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans:  $2NH_4Cl_{(aq)} + Ca(OH)_{2(aq)} \longrightarrow 2NH_{3(g)} + CaCl_{2(aq)} + 2H_2O_{(l)}$

35. Write down two important compounds with their formula which are used in the manufacture of sodium carbonate. (FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: Important compounds required for the manufacturing of sodium carbonate.

(i) Sodium chloride (NaCl) or brine.

(ii) Limestone ( $CaCO_3$ ).

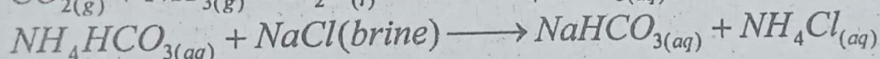
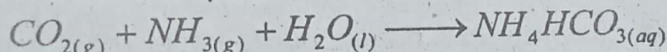
(iii) Ammonia gas ( $NH_3$ ).

36. How carbonation of ammonical brine is carried out in Solvay's process?

(SGD-I/II, DGK-II, SWL-II)

Ans: **Carbonation of Ammonical Brine in Solvay's Process:**

Ammonical brine is fed into carbonating tower and carbon dioxide is passed through it. Following reaction takes place in the carbonation tower.

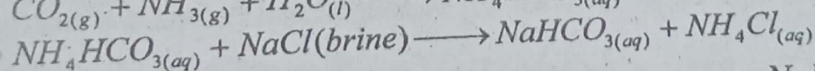
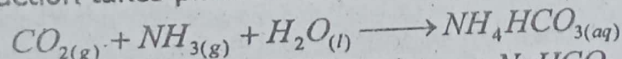


37. What happens when  $CO_2$  is passed through Ammonical brine?

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: **Carbonation of Ammonical Brine in Solvay's Process:**

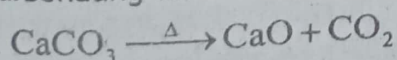
Ammonical brine is fed into carbonating tower and carbon dioxide is passed through it. Following reaction takes place in the carbonation tower.



The temperature of mixture is lowered to  $15^\circ C$  and precipitates of  $NaHCO_3$  are obtained.

38. How  $CO_2$  is prepared in Solvay's process. (LHR-I/II, MUL-I, SGD-I, DGK-I/II, SWL-I/II)

Ans: " $CO_2$ " is prepared by heating limestone in a lime kiln. Then, it is carried to the carbonating tower.



39. Complete and balance given reaction.  $2CuFeS + O_2 \longrightarrow ? + ? + ?$  (GUJ-I, FSD-I, DGK-I, SWL-I, MUL-II)

Ans:  $2CuFeS_{2(s)} + O_{2(g)} \longrightarrow Cu_2S_{(s)} + 2FeS_{(s)} + SO_{2(g)}$



## Manufacture of Urea

16.3

40. Write formula of Urea and Ammonium Carbamate.

(LHR-II, GUJ-I/II, FSD-I, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

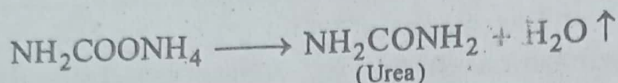
Ans: Urea:  $\text{H}_2\text{NCONH}_2$

Ammonium Carbamate:  $\text{NH}_2\text{COONH}_4$

41. How Urea is prepared from Ammonium Carbamate? Write chemical equation also.

(FSD-I/II, MUL-I/II, SGD-I/II, DGK-II, SWL-II)

Ans: When ammonium carbamate is evaporated with the help of steam, it dehydrates to form urea.



42. What is the percentage of nitrogen in urea? Also write down the formulae of urea.

(LHR-I/II, FSD-I, DGK-I, SWL-I, MUL-II)

Ans: Urea is nitrogenous fertilizer. It consists of 46.6% nitrogen.

Formula of Urea:  $\text{NH}_2\text{CONH}_2$

16.4

## Petroleum Industry

43. Write the uses of Fuel Oil.

[LHR/II, FSD-II, SGD-II, MTN-II, BWP-I, SWL-I]

Ans: Fuel oil is used for ships, boilers in industries and to heat the furnices etc.

44. Which petroleum fraction is used in dry cleaning? Write down its boiling range.

[FSD-II, DGK-II]

Ans: Petroleum ether is used in dry cleaning.

Boiling range:  $30 - 80^\circ\text{C}$

45. What is residual oil?

[SGD-I, DGK-II, MTN-I]

Ans. Residual oil: The residual oil which does not vapourize under these conditions is collected and heated above  $400^\circ\text{C}$  for further fractional distillation.

46. How carried out the refining of petroleum?

[SGD-I/II, FSD-I, BWP-II]

Ans. Refining and fractional distillation:

Refining process is the separation of crude oil mixture into various useful products (fractions) it is carried out by a process called fractional distillation.

47. What is the difference between crude oil and residual oil?

[LHR-II, RWP-I, MTN-II, SGD-I, SWL-II]

Ans. Residual oil: The oil which does not vapourize is collected and heated above  $400^\circ\text{C}$  called residual oil.

Crude oil: The remains of dead plants and animals were converted into, dark, brownish viscous liquid called crude oil.

48. What is the use of Gasoline.

[SGD-II, FSD-II, DGK-I, SWL-I]

Ans. Gasoline: It contain  $\text{C}_7 - \text{C}_{10}$  its boiling range is  $80$  to  $170^\circ\text{C}$ . Used as fuel in motor cycle, motor cars and other light vehicles. It is also used for dry cleaning.

49. Give uses of kerosene oil.

[MTN-II, DGK-I/II, FSD-I, BWP-II, SWL-II]

Ans. Uses: (i) It is used as a domestic fuel.

(ii) Its pure form can be used as jet fuel.

50. Write down the uses of Diesel and Fuel Oils.

[LHR-II, GUJ-I/II, RWP-I, MTN-II, DGK-II]

Ans. Diesel oil: It contains carbon atoms  $\text{C}_{13} - \text{C}_{15}$  and boiling range is  $250^\circ\text{C} - 350^\circ\text{C}$ . Diesel oil used as fuel for vehicle.



Fuel Oil:

It contains  $C_{15} - C_{18}$  carbon atoms. Its boiling range is  $350^{\circ}\text{C} - 400^{\circ}\text{C}$ .

It is used in ships and industries to heat furnaces.

**What is petroleum?**

51. [LHR-II, RWP-II, FSD-I, MTN-I/II, DGK-II]  
 Ans. petroleum is a complex mixture of several gaseous, liquid and solid hydrocarbons having water, salts and earth particles with it. It is lighter than water and is insoluble in it.

52. **What is a Residual Oil? Write the names of important fractions.**

[GUJ-I, MTN-I/II, BWP-II, SWL-I]

Ans. **Residual oil:** The residual oil which does not vapourize under these conditions is collected and heated above  $400^{\circ}\text{C}$  for further fractional distillation. The four fractions of residual oil are:

- (i) Lubricants      (ii) Paraffin wax      (iii) Asphalt      (iv) Petroleum coke

53. **Write down the names of different fractions of Petroleum.**

[LHR-II, GUJ-II, RWP-I, FSD-I/II, SWL-II]

- Ans. (i) Petroleum Gas      (ii) Petroleum Ether  
 (ii) Gasoline or Petrol      (iv) Fuel oil

## Solved Exercise

### Multiple Choice Questions

- Concentration is a.** (MLT-I)(ALP)  
 (a) Mixing technique      (b) Separating technique  
 (c) Boiling technique      (d) Cooling technique
- Froth flotation process is used to concentrate the ore on.** (FSD-I)(ALP)  
 (a) Density basis      (b) Concentration basis  
 (c) Wetting basis      (d) Magnetic basis
- Matte is a mixture of.** (MLT-I, GUJ-I, DGK-II, RWP-I, LHR-I)(ALP)  
 (a) FeS and CuS      (b)  $\text{Cu}_2\text{O}$  and FeO      (c)  $\text{Cu}_2\text{S}$  and FeS      (d) CuS and FeO
- In the bassemmerization process.** (SWL-I)(ALP)  
 (a) Roasted ore is heated      (b) Molten matte is removed  
 (c) Molten matte is heated      (d) Molten matte is added
- Concentration of the copper ore is carried out by.** (SWL-I, BWP-II)(ALP)  
 (a) Calcination      (b) Roasting      (c) Froth flotation      (d) Distillation
- When  $\text{CO}_2$  is passed through the ammonical brine the only salt that precipitates is:** (DGK-I, MLT-II, BWP-II)(ALP)  
 (a)  $\text{NaHCO}_3$       (b)  $\text{NH}_4\text{HCO}_3$       (c)  $\text{Na}_2\text{CO}_3$       (d)  $(\text{NH}_4)_2\text{CO}_3$
- In solvay's process slaked lime is used to.** (DGK-II, SRG-II, RWP-II, FSD-I)(ALP)  
 (a) Prepare  $\text{CO}_2$       (b) Prepare quick lime  
 (c) Recover ammonia      (d) Form  $\text{Na}_2\text{CO}_3$
- When  $\text{NaHCO}_3$  is heated it forms.** (GUJ-I, DGK-I, SRG-I, RWP-II)(ALP)  
 (a)  $\text{CO}_2$       (b)  $\text{Ca}(\text{OH})_2$       (c)  $\text{CaCO}_3$       (d) CaO
- Formula of urea is:** (MLT-I, LHR-I)(ALP)  
 (a)  $\text{NH}_2\text{COONH}_4$       (b)  $\text{NH}_2\text{COONH}_2$   
 (c)  $\text{NH}_2\text{CONH}_4$       (d)  $\text{NH}_2\text{CONH}_2$



10. Crude oil is heated in the fractionating furnace upto. (a) 300°C (b) 350°C (c) 400°C (d) 450°C
11. When crude oil is heated in the fractionating tower. (a) Vapours of higher boiling point fraction condense first in the lower part of the tower. (b) Vapours of lower boiling point fraction condense first in the lower part of tower. (c) Vapours of higher boiling point condense later in the upper part of tower. (d) Vapours of higher boiling point never condense.
12. Which one of the following is used as jet fuel. (a) Kerosene oil (b) Lubricating oil (c) Fuel oil (d) Diesel oil
13. Which one of the following is not fraction of crude oil. (a) Paraffin wax (b) Asphalt (c) Fuel oil (d) Petroleum coke
14. Which one of the following is not a fraction of petroleum? (a) Kerosene oil (b) diesel oil (c) Alcohol (d) Petrol
15. The nitrogen present in urea is used by plants to synthesize. (a) Sugar (b) Proteins (c) Fats (d) DNA
16. Which one of the following organic compound is found in gasoline? (a)  $C_2H_4$  (b)  $C_3H_8$  (c)  $C_8H_{18}$  (d)  $C_{12}H_{26}$

### Answers

|    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|
| 1  | b | 2  | c | 3  | c | 4  | c | 5  | c |
| 6  | a | 7  | c | 8  | a | 9  | d | 10 | c |
| 11 | a | 12 | b | 13 | c | 14 | c | 15 | d |
| 16 | c |    |   |    |   |    |   |    |   |

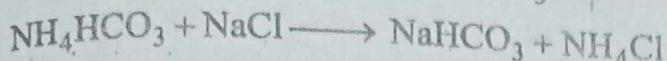
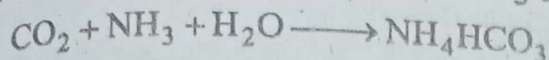
### Short Questions

1. What role is played by pine oil in the froth flotation process? (DGK-I)(ALP)  
**Ans.** In froth flotation process, oil is mixed with ore as the ore particles are preferentially wetted by oil. Oil coated ore particles being lighter come to the surface in the form of a froth that can be skimmed.
2. Name the various metallurgical operations.  
**Ans.** (i) Concentration of ore (ii) Extraction of metal  
 (iii) Refining of the metal
3. How roasting is carried out? (BWP-I, SWL-I, MLT-II)(ALP)  
**Ans.** It is process of heating concentrated re to high temperature in excess of air.  
 $2CuFeS_2 \longrightarrow Cu_2S + 2FeS + SO_2$
4. Explain process of electro-refining. (LHR-I)(ALP)  
**Ans.** Refining the impure metal by electrolysis is the most widely used process for refining. Electrolytic refining of Cu is carried out in electrolytic tank having copper sulphate solution in it. Impure copper is anode and pure copper metal acts as cathode. On electrolysis, anode dissolves to provide  $Cu^{2+}$  ions to the solution. These  $Cu^{2+}$  are discharged by gaining of electrons from the cathode. Thus copper atoms deposit on the cathode, making it thick block of pure copper metal. The impurities like gold and silver settle down as anode mud.
5. What are advantages of solvay's process?  
**Ans.** (i) It is a cheap process as raw materials are available at very low prices.  
 (ii) Carbon dioxide and ammonia are recovered and reused.  
 (iii) Process is pollution free, because the only waste is calcium chloride solution.  
 (iv) Sodium carbonate of very high purity is obtained.  
 (v) Consumption of fuel is very less since no solution is to be evaporated.
6. What is the principle of solvay's process? (DGK-II, LHR-I)(ALP)  
**Ans.** It lies in the low solubility of sodium carbonate at low temperature i.e. 15°C. When  $CO_2$  is passed through an ammonical solution of NaCl called ammonical brine, only  $NaHCO_3$  precipitates.



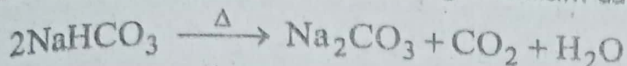
**What happens when ammonical brine is carbonated?**

7. **Ans.** Ammonical brine is fed into carbonating tower and  $\text{CO}_2$  is passed through it.



**How  $\text{NaHCO}_3$  is converted to  $\text{Na}_2\text{CO}_3$ ?**

8. **Ans.** Sodium bicarbonate is heated to get sodium carbonate. (SWL-I, MLT-I, FSD-I, LHR-I) (ALP)



9. **How ammonia is recovered in the solvay's process?**

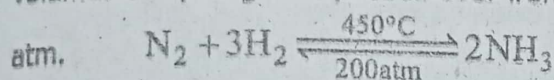
**Ans.** Ammonia is recovered in this tower from ammonium chloride solution produced in the carbonated tower calcium hydroxide formed in lime kiln. (RWP-I, MLT-I, FSD-I) (ALP)

**Equation:**



**Q10. How ammonia is prepared for the synthesis of urea?**

**Ans.** It is prepared by the Haber process. In Haber process, one volume of nitrogen and three volumes of hydrogen is passed over iron catalyst at  $450^\circ\text{C}$  and 200



**Q11. Describe the formation of petroleum.**

**Ans.** Petroleum was formed by the decomposition of dead plants and animals buried under earth's crust millions of years ago. It is believed that millions of years ago living plants and animals in the seas died. Their bodies sank and buried under mud and sand. Then decomposition process took place at high temperature and pressure conditions in the absence of air which resulted into formation of petroleum.

**Q12. What is refining of petroleum and how it is carried out?**

**Ans.** Refining is the process in which separation of crude oil mixture into various useful products is done. It is carried out by a process called fractional distillation. It is based upon separation of substance depending upon their boiling point.

**Q13. Give a use of kerosene oil.**

**Ans.** It is used as domestic fuel and a special grade of it is used as jet fuel.

**Q14. Describe the difference between diesel oil and fuel oil.**

**Ans.**

| Diesel oil  | Fuel Oil  |
|---|---|
| a) It contains carbon atoms                                     | a) It contains carbon atoms   |
| b) Its boiling range is $250^\circ\text{C} - 350^\circ\text{C}$ | b) Its boiling range is $350^\circ\text{C} - 400^\circ\text{C}$     |
| c) Diesel oil used as fuel for vehicle                          | c) It is used in ships and industries to heat furnaces and boilers. |

**Q15. Write down the names of four fractions obtained by the fractional distillations.**

**Ans.** (i) Lubricants (ii) Paraffin wax  
(iii) Asphalt (iv) Petroleum coke

**Q16. What is the difference between crude oil and residual oil?**

**Ans.**

| Residual oil  | Crude oil  |
|---|--|
| a) The oil which does not vapourize is collected and heated above $400^\circ\text{C}$ called residual oil.                | a) The remains of dead plants and animals were converted into, dark, brownish viscous liquid called crude oil.   |
| b) Four fractions of residual oil are obtained:-<br>(i) Lubricants (ii) Paraffin wax<br>(iii) Asphalt (iv) Petroleum coke | b) Six fractions of crude oil are obtained after fractional distillation:-<br>(i) Petroleum Gas (ii) Petroleum Ether<br>(iii) Gasoline or Petrol (iv) Kerosene oil<br>(v) Diesel oil (vi) Fuel oil |



17. Which petroleum fraction is used in dry cleaning?

Ans: (i) Petroleum Ether (ii) Gasoline or Petrol

### Extensive Questions

1. What do you know about concentration of the ore? Explain Froth flotation process. [GUJ-II, RWP-II, DEK-I, BWP-II]

Ans. Concentration of the ore:

The process of removal of gangue from the ore is technically known as concentration of ore.

**Froth flotation process:**

Froth flotation process is based on the wetting characteristic of the ore and the gangue particles with oil and water, respectively.

**Procedure:**

The ore particles are preferentially wetted by the oil and the gangue particles by the water. The whole mixture is agitated with compressed air. Hence, oil coated ore particles being lighter come to the surface in the form of a froth that can be skimmed.

2. Explain the process of smelting with reference to copper.

[FSD-I, DGK-II, BWP-I, MTN-I/II]

Ans: Smelting:

Smelting is further heating the roasted ore with sand flux and coke in the presence of excess of air in a blast furnace.

Blast furnace for smelting of copper

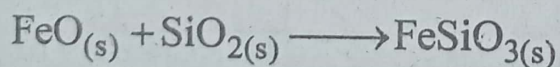
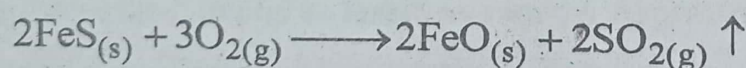
**Need of coke:** During the combustion, a lot of heat is released therefore a small amount of coke is required in the process.

Chemical reactions:

During the smelting process following chemical reactions take place:

(a) **Formation of slag:** Ferrous sulphide is oxidized to ferrous oxide, which reacts with sand to form iron silicate slag ( $\text{FeSiO}_3$ )

Equation:

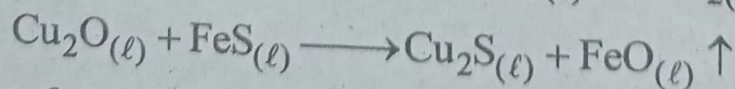
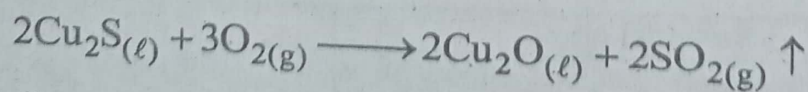


**Removal of silicates:** These silicates being lighter rise to the top and form an upper layer which is removed from the upper hole.

(b) **Formation of matte:** Cuprous sulphide is also oxidized to form cuprous oxide, which reacts with unreacted ferrous sulphide to form ferrous oxide and cuprous sulphide.

Matte: A mixture of cuprous sulphide along with some unreacted ferrous sulphide. form a mixture it is called matte (molten matter).

Equations:



3. Write advantages of solvay's process.

[GUJ-I/II, FSD-I/II, DGK-I]

Ans: (i) **Cheap process:** It is a cheap process as raw materials are available at very low prices.

(ii) **Reuse and recovered reactants:**

Carbonate dioxide and ammonia are recovered and reused.



- (iii) **Free of pollution:**  
Process is pollution free, because of the only waste calcium chloride solution.
- (iv) **Pure products:**  
Sodium carbonate of very high purity is obtained.
- (v) **Consumption of lesser fuel:**  
Consumption of fuel is very less since no solution is to evaporated.
4. **How urea is manufactured? Explain showing the flows sheet diagram.**

[GUJ-I, MTN-I/II, BWP-II, SWL-I]

Ans. Urea is nitrogen fertilizer.

**Composition of urea:** It consists of 46.6% nitrogen.

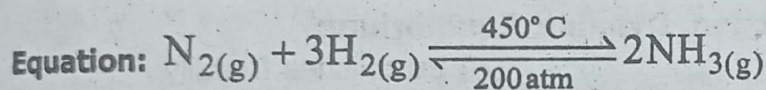
**Properties of urea:** It is used for the manufacturing of important chemicals, but its major (about 90%) use is as a fertilizer.

**Raw Materials:** The raw materials for manufacturing of urea are.

- (I) Ammonia ( $\text{NH}_3$ )      (II) Carbon dioxide ( $\text{CO}_2$ )

### Haber's Process:

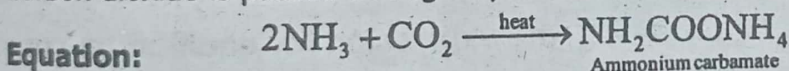
Ammonia is prepared by the "Haber's process". One volume of nitrogen (from air) and three volumes of hydrogen (obtained by passing methane and steam over heated nickel catalyst) is passed over iron catalyst at  $450^\circ\text{C}$  and 200 atm pressure.



**Process:** Manufacturing of urea involves three stages:

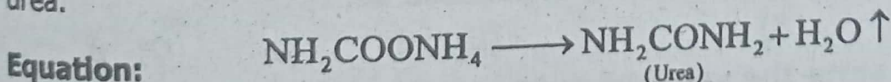
- (i) Reaction of ammonia and carbon dioxide.  
(ii) Urea formation      (iii) Granulation of urea  
(i) Reaction of ammonia and carbon dioxide:

Carbon dioxide is passed through liquid ammonia under high pressure to form.

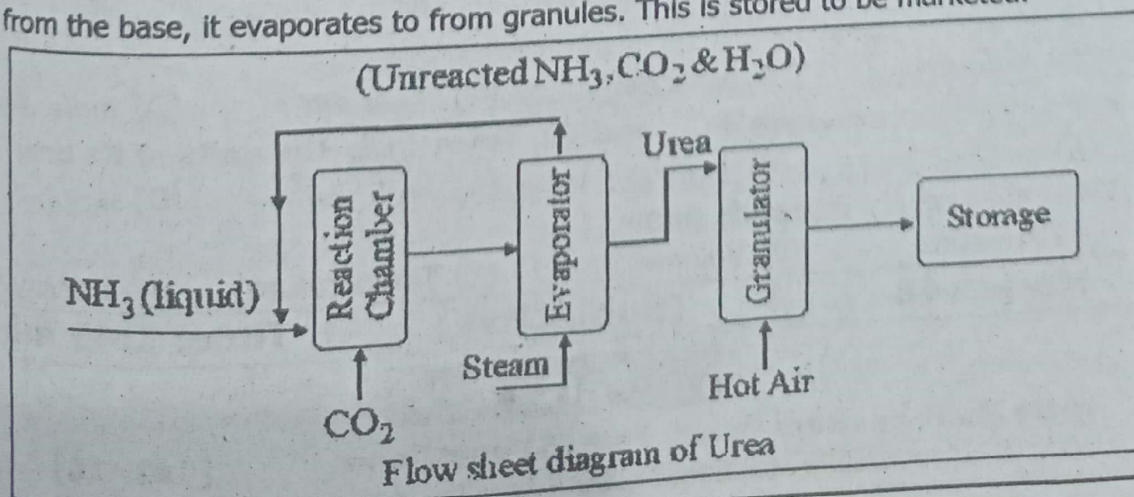


### (ii) Urea formation:

When ammonium carbamate is evaporated with the help of steam, it dehydrates to form urea.



- (iii) **Granulation of urea:** At this stage, liquid urea is evaporated to form granules. When liquid urea is sprayed from top of a tower under pressure a hot current of air is introduced from the base, it evaporates to form granules. This is stored to be marketed.





Total Marks: 12

(Objectives)

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| A | B | C | D |

Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- When a system is at equilibrium state then:
  - (A) the concentration of reactants and products becomes equal
  - (B) the opposing reactions (forward and reverse) stop
  - (C) the rate of reverse reaction becomes very low
  - (D) the rates of forward and reverse reactions become equal.
- In a chemical reaction, the substances that combine are called:
  - (A) Reactants
  - (B) Products
  - (C) Equilibrium
  - (D) Numerator
- The color of HI is:
  - (A) Orange
  - (B) Purple
  - (C) Colourless
  - (D) Red
- In an Irreversible Reaction, Dynamic Equilibrium:
  - (A) Never Establishes
  - (B) Establishes Readily
  - (C) Establishes after the completion of Reaction
  - (D) Establishes before the completion
- Possibilities are there at equilibrium state:
  - (A) 1
  - (B) 2
  - (C) 3
  - (D) 4
- $2H_{2(g)} + O_{2(g)} \xrightarrow{\Delta} 2H_2O_{(g)}$  this reaction is an example of:
  - (A) Reversible
  - (B) Forward
  - (C) Reverse
  - (D) Irreversible
- For the reaction  $2A_{(g)} + B_{(g)} \rightleftharpoons 3C_{(g)}$  the expression for equilibrium constant is:
  - (A)  $\frac{[C]^3}{[A]^2[B]}$
  - (B)  $\frac{[3C]}{[2A][B]}$
  - (C)  $\frac{[A]^2[B]}{[C]^3}$
  - (D)  $\frac{[2A][B]}{[3C]}$
- Molar concentration ( $\text{mol dm}^{-3}$ ) is expressed as:
  - (A) { }
  - (B) ( )
  - (C) [ ]
  - (D)  $\emptyset$
- At equilibrium state the value of  $K_c$  is equal to:
  - (A)  $\frac{K_r}{K_f}$
  - (B)  $\frac{K_f}{K_r}$
  - (C)  $\frac{K_r}{R_r}$
  - (D)  $\frac{R_f}{R_r}$
- Unit of active mass is:
  - (A) mole dm
  - (B) mole  $\text{dm}^{-1}$
  - (C) mole  $\text{dm}^{-3}$
  - (D) mole  $\text{dm}^{-2}$
- For a reaction between  $\text{PCl}_3$  and  $\text{Cl}_2$  form  $\text{PCl}_5$  the units of  $K_c$  are:
  - (A)  $\text{mol dm}^{-3}$
  - (B)  $\text{mol}^{-1} \text{dm}^{-3}$
  - (C)  $\text{mol}^{-1} \text{dm}^3$
  - (D)  $\text{mol dm}^3$
- The value of  $K_c$  depends upon.
  - (A) Pressure
  - (B) Volume
  - (C) Temperature
  - (D) Density

Marks: 48

(Subjective)

Time: 1:45 minute

Part - I

- Write short answers to any Five (5) questions:
  - (i) What are irreversible reactions? Give a few characteristics of them. [5x2=10]



What is meant by static equilibrium? Give an example.  
Write two possibilities of chemical equilibrium state.

How is dynamic equilibrium established?

Why at equilibrium state reaction does not stop? (vi) Define Chemical Equilibrium State.  
Differentiate between Reversible and Irreversible Reaction. Explain with example.  
Complete the following equations:



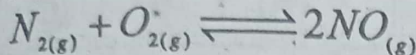
**Write short answers to any Five (5) questions:**

[5x2=10]

Write down the equilibrium constant expression for given equation.  $2\text{NO}_2 \rightleftharpoons \text{N}_2\text{O}_4$

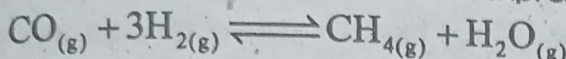
Write the equilibrium constant expression for the reaction.  $\text{PCl}_3 + \text{Cl}_2 \rightleftharpoons \text{PCl}_5$

Write the equilibrium constant expression for the following reaction



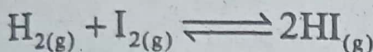
What is active mass? Also write its unit.

Write the equilibrium constant expression for given equation.



Write down the expression of  $K_c$  for a General Reversible Reaction.

Write the equilibrium constant expression for the following reaction:



What is relation between active mass and rate of reaction?

**Write short answers to any Five (5) questions:**

[5x2=10]

What is equilibrium constant? Write down its unit as well.

What are numerator and denominator?

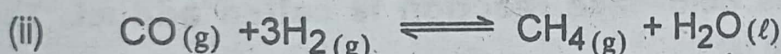
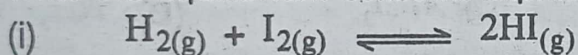
Write the Equilibrium Constant Expression for the given reaction.

For which reactions Equilibrium constant has no units?

Why equilibrium state is attainable from either way?

Derive equilibrium constant expression for the synthesis of ammonia from nitrogen and hydrogen.

Write the equilibrium constant expression of the following reactions.



How can you know that a reaction has achieved an equilibrium state?

## Part - II

**NOTE:- Attempt any two questions.**

[9x2=18]

5. (a) State the law of Mass Action and derive the expression for equilibrium constant for a general reaction.

(b) For the decomposition of dinitrogen oxide ( $\text{N}_2\text{O}$ ) into nitrogen and oxygen reversible reaction takes place as follows.  $2\text{N}_2\text{O}_{(g)} \rightleftharpoons 2\text{N}_{2(g)} + \text{O}_{2(g)}$   
The concentration of  $\text{N}_2\text{O}$ ,  $\text{N}_2$  and  $\text{O}_2$  are  $1.1 \text{ mol dm}^{-3}$ ,  $3.90 \text{ mol dm}^{-3}$  and  $1.95 \text{ mol dm}^{-3}$ , respectively, at equilibrium. Find out  $K_c$  for this reaction.

6. (a) What is the importance of equilibrium constant?

(b) When nitrogen reacts with hydrogen to form ammonia, the equilibrium mixture contains  $0.31 \text{ mol.dm}^{-3}$  and  $0.50 \text{ mol.dm}^{-3}$  of nitrogen and hydrogen respectively. If the  $K_c$  is  $0.50 \text{ mol}^{-2}\text{dm}^6$ , what is the equilibrium concentration of ammonia?

7. (a) For the formation of ammonia by Haber's process hydrogen and nitrogen react reversibly at  $500^\circ\text{C}$  as follows.  $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$   
The equilibrium concentrations of these gases are nitrogen  $0.602 \text{ mol dm}^{-3}$ , hydrogen  $0.420 \text{ mol dm}^{-3}$  and ammonia  $0.113 \text{ mol dm}^{-3}$ . What is value of  $K_c$  solution.

(b) For a reaction between  $\text{PCl}_3$  and  $\text{Cl}_2$  to form  $\text{PCl}_5$  the equilibrium constant is  $0.13 \text{ mol}^{-1} \text{ dm}^3$  at a particular temperature. When the equilibrium concentrations of  $\text{PCl}_3$  and  $\text{Cl}_2$  are 10 and  $9 \text{ mol dm}^{-3}$  respectively. What is equilibrium concentration of  $\text{PCl}_5$ .



Total Marks: 12

(Objectives)

Time: 15 mint

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| (A) | (B) | (C) | (D) |

Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Acids have taste:  
(A) bitter (B) sweetish (C) sour (D) saltish
- The conjugate base of sulphuric acid is:  
(A)  $\text{SO}_3^{2-}$  (B)  $\text{S}^{2-}$  (C)  $\text{SO}_3^{2-}$  (D)  $\text{HSO}_4^-$
- Arrhenius Presented his concept of Acids and Bases in:  
(A) 1787 (B) 1887 (C) 1987 (D) 1990
- Among following given compounds which is not Lewis acid?  
(A)  $\text{H}^+$  (B)  $\text{BF}_3$  (C)  $\text{AlCl}_3$  (D)  $\text{NH}_3$
- The product of Lewis acid-base reaction is called adduct. The bond between adduct specie is:  
(A) Ionic (B) Covalent (C) Metallic (D) Coordinate covalent
- Which base is more corrosive?  
(A)  $\text{NH}_4\text{OH}$  (B)  $\text{NaOH}$  (C)  $\text{Ca}(\text{OH})_2$  (D)  $\text{Al}(\text{OH})_3$
- Acid occuring in sour milk:  
(A) Citric Acid (B) Lactic Acid (C) Butric Acid (D) Malic Acid
- Dilute acids react with carbonates to produce the given products except:  
(A) Salt (B) Water (C) Carbondioxide (D) Hydrogen
- Acetic acid is used for:  
(A) flavouring food (B) Making explosive  
(C) Etching designs (D) Cleaning metals
- Soda lime is a mixture of:  
(A)  $\text{CaCl}_2, \text{KOH}$  (B)  $\text{NaOH}, \text{CaO}$  (C)  $\text{NaOH}, \text{CaCl}_2$  (D)  $\text{Ca}(\text{OH})_2, \text{CaO}$
- The formula of pH is:  
(A)  $\text{pH} = \log[\text{H}^+]$  (B)  $\text{pH} = -\log[\text{H}^+]$   
(C)  $\text{pH} = -\log[\text{H}^-]$  (D)  $\text{pH} = \log[\text{OH}^-]$
- pH of neutral substances is always equal to:  
(A) 0 (B) 5 (C) 7 (D) 14



Marks: 48

(Subjective)

Time: 1:45 minute

## Part - I

Write short answers to any Five (5) questions:

[5x2=10]

2. Define base and give an example.
- (i) What is difference between Lewis acid and base?
- (ii) Prove that water is an amphoteric specie.
- (iii) What is conjugate acid? Define it.
- (iv) Which kind of bond forms between Lewis acid and base?
- (v) Define a Base. Why all Alkalies are Bases but all Bases are not Alkalies?
- (vi) Define acid and base according to Arrhenius concept.
- (vii) What do you mean by Conjugate Bases? Give one example.
- (viii)

Write short answers to any Five (5) questions:

[5x2=10]

3. Name the alkali used in alkaline batteries.
- (i) Name an acid used in the preservation of food.
- (ii) Give four uses of Nitric acid.
- (iii) Write any two characteristics (properties) of bases.
- (iv) Write formula of an acid and base.
- (v) Name the acids present in rancid butter and citrus fruits.
- (vi) Write chemical formula and use of Ammonium hydroxide.
- (vii) Write down formulas of the following.
- (viii)

- (a) Nitric acid
- (b) Phosphoric acid
- (c) Calcium Hydroxide
- (d) Aluminium Hydroxide

Write short answers to any Five (5) questions:

[5x2=10]

4. A solution of HCl is 0.01M. What is its pH value?
- (i) Find out the pOH of 0.001M solution of KOH.
- (ii) What is the purpose of pH meter?
- (iii) How pH of a solution is measured by using universal indicator?
- (iv) What is neutralization reaction? Write a chemical equation as well.
- (v) Define salts.
- (vi) How soluble salt recovered from water?
- (vii) How salt is prepared by the reaction of an acid and metallic oxide.
- (viii)

## Part - II

NOTE:- Attempt any two questions.

[9x2=18]

5. (a) Define acid and base according to Bronsted-Lowery concept and justify that water is amphoteric compound with example.
- (b) Calculate the pH and pOH of  $0.2\text{M H}_2\text{SO}_4$ ?
6. (a) Explain with examples that how soluble salts are prepared?
- (b) A solution of Hydrochloric acid is 0.01M. What is its pH value?
7. (a) Explain why:
  - i. HCl forms only one series of salts.
  - ii.  $\text{H}_2\text{SO}_4$  form three series of salts.
  - iii.  $\text{H}_3\text{PO}_4$  form three series of salts.

Give necessary equations.

- (b) Find out the pH and pOH of 0.001M solution of KOH?



## Chapter Wise Self Test

3

## Chapter 11:

## Organic Chemistry


Time: 15 mint

Total Marks: 12

(Objectives)

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| 2 | (A) | (B) | (C) | (D) | 8  | (A) | (B) | (C) | (D) |
| 3 | (A) | (B) | (C) | (D) | 9  | (A) | (B) | (C) | (D) |
| 4 | (A) | (B) | (C) | (D) | 10 | (A) | (B) | (C) | (D) |
| 5 | (A) | (B) | (C) | (D) | 11 | (A) | (B) | (C) | (D) |
| 6 | (A) | (B) | (C) | (D) | 12 | (A) | (B) | (C) | (D) |

Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Benzene ring  is an example of:
  - Alicyclic compound
  - Aromatic compound
  - Heterocyclic compound
  - Straight chain
- The example of heterocyclic compound is:
  - benzene
  - hexane
  - cyclohexane
  - Pyridine
- All known organic compounds have been broadly divided into categories depending upon their carbon skeleton:
  - 1
  - 2
  - 3
  - 4
- Open chain compounds are those in which the end carbon atoms are \_\_\_\_:
  - Joined
  - One line
  - Two line
  - not joined
- Open chain compounds also called:
  - Aliphatic
  - Cyclic
  - Covalent
  - Ionic
- Cyclic compounds that contain one or more atoms other than that of carbon atoms in their rings are called \_\_\_\_:
  - Alicyclic
  - Heterocyclic
  - Aromatic compounds
  - Covalent
- The general formula of alkane is:
  - $C_nH_{2n+2}$
  - $C_nH_{2n+1}$
  - $C_nH_{2n}$
  - $C_nH_{2n-2}$
- Hydro compounds are regarded as \_\_\_\_ organic compounds Hydrocarbons:
  - Parent
  - Derivatives
  - Complex
  - Non complex
- Which one is carboxylic group?
  - $\text{>C=O}$
  - $\begin{array}{c} \text{O} \\ \parallel \\ \text{-C-OH} \end{array}$
  - $\begin{array}{c} \text{O} \\ \parallel \\ \text{R-C-OH} \end{array}$
  - $\begin{array}{c} \text{O} \\ \parallel \\ \text{-C-H} \end{array}$
- Functional group of alcohols is:
  - COOH
  - $>\text{C=O}$
  - C-O-C
  - OH
- Class formula of tertiary alcohol is:
  - R-O-R
  - $\begin{array}{c} \text{R} \\ | \\ \text{R-C-OH} \\ | \\ \text{R} \end{array}$
  - $\begin{array}{c} \text{R} \\ | \\ \text{CH-OH} \\ | \\ \text{R} \end{array}$
  - $\text{R-CH}_2\text{-OH}$
- What is the molecular formula for butane?
  - $C_4H_6$
  - $C_4H_{10}$
  - $C_4H_{12}$
  - $C_4H_8$



Marks: 48

(Subjective)

Time: 1:45 minute

### Part - I

Write short answers to any Five (5) questions:

[5x2=10]

2. (i) Define molecular formula and give one example.
- (ii) What is Electronic or Dot and Cross formula?
- (iii) Write structural formulae of Iso-Pentane and neo pentane.
- (iv) Define condensed formula with an example.
- (v) Write down the Dot and Cross Formula of Propane and n-Butane.
- (vi) Why benzene is called aromatic compound.
- (vii) What are Aromatic Compounds? Give an example.
- (viii) What are Alicyclic compounds? Give an example.

Write short answers to any Five (5) questions:

[5x2=10]

3. (i) Define open chain or acyclic compounds.
- (ii) Write any two names of aromatic compounds.
- (iii) Define Homologous Series.
- (iv) How are alkyl radicals formed? Explain with an example.
- (v) What is the difference between n-propyle and isopropyle? Explain with structure.
- (vi) Explain different radicals of butane.
- (vii) Write the formulae of: (i) Acetylene (ii) Ethyl Alcohol
- (viii) What is ether linkage?

Write short answers to any Five (5) questions:

[5x2=10]

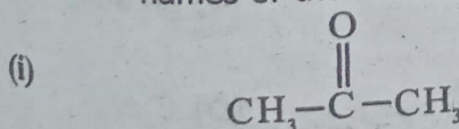
4. (i) What is alcoholic functional group. Give examples.
- (ii) Write formula of methyl acetate and Ethyl acetate.
- (iii) Write down the structural formulae of acetone and trimethylamine.
- (iv) Write a difference between Aldehydic Group and Ketonic Group.
- (v) How alkyl radicals are formed? Explain with examples.
- (vi) What is the difference between n-propyl and isopropyl? Explain with structure.
- (vii) What is an ester group? Write down the formula of ethyl acetate.
- (viii) Define structural formula. Draw the structural formula of n-butane and isobutene.

### Part - II

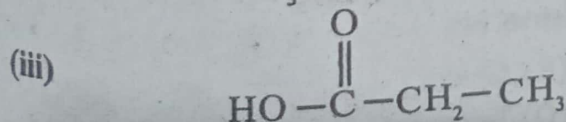
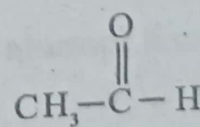
NOTE:- Attempt any two questions.

[9x2=18]

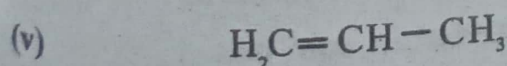
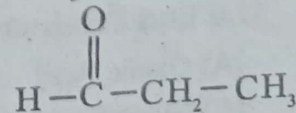
5. (a) Write down the characteristics of homologous series.
- (b) Write a detailed note on functional groups of alkenes and alkynes. How they are identified from other compounds?
6. (a) Write a detailed note on classification of organic compounds.
- (b) Write down the characteristics of homologous series.
7. (a) Differentiate between aldehydic and ketonic functional groups. How both are identified from each other?
- (b) Encircle the functional groups in the following compounds. Also give the names of the functional groups?



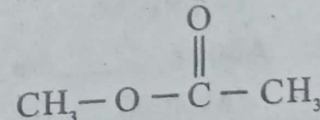
(ii)



(iv)



(vi)





## Chapter Wise Self Test

4

## Chapter 12:

## Hydrocarbons

Time: 15 min

Total Marks: 12

(Objectives)

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Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Which one of the following compounds is a saturated hydrocarbon:  
(A) Methane (B) Ethyne (C) Propene (D) Propyne
- Which is a substitution reaction?  
(A) Halogenation of alkynes (B) Halogenation of alkenes  
(C) Halogenation of alkanes (D) Bromination of alkenes
- Alkanes are also known as:  
(A) Halogens (B) Paraffins (C) Olefins (D) Acetylenes
- Halogenation of Methane does not produce:  
(A) Carbon Black (B) Chloroform  
(C) Chloromethane (D) Carbon tetrachloride
- Which one is also called "Olefins"?  
(A) alkanes (B) alkenes (C) alkynes (D) alcohols
- Alkenes are prepared from alcohols by a process called:  
(A) Dehydrogenation (B) Dehalogenation  
(C) Dehydrohalogenation (D) Dehydration
- Oxidation of Ethene with  $\text{KMnO}_4$  Produces:  
(A) Oxalic acid (B) Glyoxal (C) Ethane glycol (D) Propene glycol
- Oxidation of Alkenes produce:  
(A) Glyoxal (B) Glycol (C) Oxalic acid (D) Formic acid
- Dehalogenation of Tetra Halides takes place in the presence of:  
(A) K (B) Mg (C) Na (D) Zn dust
- General formula of alkynes is:  
(A)  $\text{C}_n\text{H}_{2n-2}$  (B)  $\text{C}_n\text{H}_{2n+2}$  (C)  $\text{C}_n\text{H}_{2n+1}$  (D)  $\text{C}_n\text{H}_{2n}$
- The End Product of Oxidation of Acetylene is:  
(A) Oxalic Acid (B) Glycol  
(C) Glyoxal (D) Potassium Hydroxide
- About \_\_\_\_\_ % traces of acetylene are present in coal gas.  
(A) 0.06 (B) 0.07 (C) 0.08 (D) 0.09



Marks: 48

(Subjective)

Time: 1:45 minute

## Part - I

**Write short answers to any Five (5) questions:**

[5x2=10]

2. (i) Differentiate between Saturated and Unsaturated Hydrocarbons.
- (ii) Define Unsaturated Hydrocarbons with general formula.
- (iii) Why are the alkanes called paraffins?
- (iv) How Hydrocarbons are used as fuel?
- (v) How can we prepare alkanes by the reduction of alkyl halides?
- (vi) What do you know about halogenation of Alkanes?
- (vii) Define the process of hydrogenation. Give example.
- (viii) Describe the preparation of Alkanes from Alkyl Halides.

**Write short answers to any Five (5) questions:**

[5x2=10]

3. (i) Why colour of bromine water discharges a addition of ethene in it?
- (ii) What are addition reactions? Explain with an example.
- (iii) What happens when ethyl alcohol is heated in the presence of  $H_2SO_4$ ?
- (iv) Describe two physical properties of alkenes.
- (v) How Halogenation take place in Alkenes? Give its chemical equation.
- (vi) Which reaction is used to identify the unsaturation of an organic compound?
- (vii) Why are alkenes reactive?
- (viii) Write the equation for the conversion of oil into ghee.

**Write short answers to any Five (5) questions:**

[5x2=10]

4. (i) Write down the Molecular and Structural formula of Ethyne.
- (ii) Write down two uses of Acetylene.
- (iii) Give the preparation of Alkynes by Dehydrohalogenation of vicinal dihalides.
- (iv) Which functional groups are present in alkenes and alkynes?
- (v) Write the Molecular and Structural Formula of Ethyne.
- (vi) Write any two uses of Ethylene.
- (vii) Write the name and molecular formula of the simplest alkyne.
- (viii) Write one use of each of acetylene and chloroform.

## Part - II

**NOTE:- Attempt any two questions.**

[9x2=18]

5. (a) What type of reactions are given by alkanes? Explain with reference to halogenations of alkanes.
- (b) Why butane undergoes substitution reactions?
6. (a) Prepare the following as directed:
  - (i) ethylene glycol from ethene;
  - (ii) 1,2-dibromoethane from ethene;
- (b) Acetylene undergoes addition reactions in two stages.
7. (a) Explain the oxidation of acetylene.
- (b) Prepare the following as directed:
  - (i) acetylene from alkyl tetrahalide;
  - (ii) carbon tetrachloride from methane;



## Chapter Wise Self Test

5

## Chapter 13:

## Biochemistry

Time: 15 mint

Total Marks: 12

(Objectives)

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| 2 | (A) | (B) | (C) | (D) | 8  | (A) | (B) | (C) | (D) |
| 3 | (A) | (B) | (C) | (D) | 9  | (A) | (B) | (C) | (D) |
| 4 | (A) | (B) | (C) | (D) | 10 | (A) | (B) | (C) | (D) |
| 5 | (A) | (B) | (C) | (D) | 11 | (A) | (B) | (C) | (D) |
| 6 | (A) | (B) | (C) | (D) | 12 | (A) | (B) | (C) | (D) |

Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Lactose consists of glucose and:
  - sucrose
  - maltose
  - starch
  - galactose
- The most important oligo saccharide is:
  - sucrose
  - glucose
  - fructose
  - maltose
- When Glucose and Fructose combine they produce:
  - Sucrose
  - Cellulose
  - Starch
  - Non these
- General formula of carbohydrates is:
  - $C_nH_{2n}$
  - $C_n(H_2O)_n$
  - $C_n(OH)_n$
  - none of these
- Maltose is generally found in:-
  - Milk
  - Cereals
  - Dairy products
  - Cotton
- Fatty acids are the building blocks of:
  - lipids
  - protein
  - glucose
  - vitamin
- Formula of stearic acid is:
  - $C_{17}H_{35}COOH$
  - $C_{17}H_{33}COOH$
  - $C_{17}H_{37}COOH$
  - $C_{15}H_{31}COOH$
- Rancid butter has a foul smell because of:
  - Butanoic acid
  - Nitric acid
  - Tartaric acid
  - Sulphuric acid
- Formula of Palmitic acid is:
  - $C_5H_{11}COOH$
  - $C_{18}H_{37}COOH$
  - $C_{17}H_{35}COOH$
  - $C_{15}H_{31}COOH$
- The organic compounds used as drugs to control bleeding are:
  - Vitamins
  - Proteins
  - Lipids
  - Glycerides
- About 50% of the dry weight of cell is made up of:
  - Carbohydrates
  - Lipids
  - Proteins
  - Vitamins
- Amino acids which cannot be synthesized by our body:
  - Non Essential
  - Proteins
  - Essential
  - Amino acids



Marks: 48

(Subjective)

Time: 1:45 minute

## Part - I

Write short answers to any Five (5) questions:

[5x2=10]

2. Define carbohydrates, write their general formula.
- (i) Give the characteristics of polysaccharides.
- (ii) Give characteristics of monosaccharides.
- (iii) Describe sources of sucrose and starch.
- (iv) What are Monosaccharides?
- (v) Define polysaccharides and give one example.
- (vi) Give the characteristic of monosaccharides.
- (vii) Give an example of a disaccharide. How it is hydrolyzed into monosaccharides?

Write short answers to any Five (5) questions:

[5x2=10]

3. (i) What are carbohydrates? Write names of three classes.
- (ii) Give the characteristics of disaccharides (any two).
- (iii) Give characteristics of oligosaccharides.
- (iv) Define reducing sugar with example.
- (v) Write down the balanced equation for the formation of glucose.
- (vi) Lactose is disaccharide; which monosaccharides are present in it?
- (vii) How are proteins formed?
- (viii) Name two fatty acids with their formulae.

Write short answers to any Five (5) questions:

[5x2=10]

4. (i) Give general formula of amino acid.
- (ii) What is the difference between Essential and Non-essential Amino Acids.
- (iii) Write the chemical formulas of palmitic acid and stearic acid.
- (iv) What is Hydrogenation of vegetable oil? Write equation.
- (v) Write down the general formula of lipids.
- (vi) Write the general formula of triglycerides.
- (vii) Shortly brief that Plants are source of Oil.
- (viii) Differentiate between oil and Fat?

## Part - II

[9x2=18]

NOTE:- Attempt any two questions.

5. What are carbohydrates? How monosaccharide are prepared? Give their characteristics.
6. What are polysaccharides, give their properties?
7. Explain that amino acids are building blocks of proteins.



Total Marks: 12

(Objectives)

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Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Just above the earth's surface is:  
(A) Mesosphere (B) Stratosphere (C) Thermosphere (D) Troposphere
- Depending upon temperature variation, atmosphere is divided into how many regions:  
(A) 1 (B) 2 (C) 3 (D) 4
- A strange bitter smell noticed near photo copier machine is of:  
(A)  $H_2S$  (B)  $SO_2$  (C)  $O_3$  (D)  $O_2$
- Temperature range of thermosphere is:  
(A)  $17^\circ C$  —  $-58^\circ C$  decreases (B)  $-58^\circ C$  —  $2^\circ C$  increases  
(C)  $2^\circ C$  —  $-93^\circ C$  decreases (D)  $> -93^\circ C$  increases
- Which is secondary pollutant:  
(A)  $H_2SO_4$  (B)  $CO_2$  (C) CO (D)  $SO_3$
- Which gas is called green house gas?  
(A)  $CO_2$  (B) CO (C)  $N_2$  (D)  $O_3$
- The Earth's atmosphere is getting hotter because of:  
(A) Increasing concentration of  $CO_2$  (B) Increasing concentration of CO  
(C) Increasing concentration of  $O_3$  (D) Increasing concentration of  $SO_2$
- Life gas for plants is:  
(A) CO (B)  $CO_2$  (C)  $CH_4$  (D)  $O_2$
- Buildings are being damaged by Acid Rain because it attacks:  
(A) Calcium Sulphate (B) Calcium Carbonate  
(C) Calcium Nitrate (D) Calcium Oxalate
- Ozone is beneficial for us as it:  
(A) absorbs infrared radiations (B) absorbs ultraviolet radiations  
(C) absorbs chlorofluorocarbons (D) absorbs air pollutants
- Buildings are being damaged by acid rain because it attacks:  
(a) calcium sulphate (b) calcium nitrate  
(c) calcium carbonate (d) calcium oxalate
- Global warming causes rising of the sea level. The cause of global warming is:  
(a)  $CO_2$  gas (b)  $SO_2$  gas (c)  $NO_x$  gases (d)  $O_3$  gas



Marks: 48

(Subjective)

Time: 1:45 minute

## Part - I

**Write short answers to any Five (5) questions:**

[5x2=10]

2. (i) Why 75% atmospheric mass is found in troposphere?
- (ii) Why is the temperature of upper stratosphere is higher?
- (iii) Write down the range of height and temperature of mesosphere.
- (iv) What is the difference between Atmosphere and Environment?
- (v) Why the concentration of Ozone in Stratosphere remains nearly constant?
- (vi) State the phenomenon of decreasing temperature in troposphere.
- (vii) State the major sources of CO and CO<sub>2</sub> emissions.
- (viii) CO is hidden enemy, explain its action.

**Write short answers to any Five (5) questions:**

[5x2=10]

3. (i) What do you mean by an Air Pollutant?
- (ii) Identify as primary and secondary pollutants. SO<sub>2</sub>, CH<sub>4</sub>, HNO<sub>3</sub>, NH<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, O<sub>3</sub>.
- (iii) Give two effects of global warming.
- (iv) Why CO<sub>2</sub> is called green house gas?
- (v) What is global warming? Write its effects.
- (vi) How is CO<sub>2</sub> responsible for heating up atmosphere?
- (vii) How ozone layer forms in stratosphere?
- (viii) How ozone layer is being depleted by chlorofluocarbons?

**Write short answers to any Five (5) questions:**

[5x2=10]

4. (i) How does acid rain increase the acidity of soil?
- (ii) State any two effects of acid rain.
- (iii) Ozone is beneficial for human life, justify.
- (iv) Why acid rain damages buildings?
- (v) Define Ozone and Ozone hole.
- (vi) Which air pollutant is produced on anaerobic decomposition of organic matter?
- (vii) How acid rain increases the acidity of soil?
- (viii) How ozone layer forms in stratosphere?

## Part - II

[9x2=18]

**NOTE:- Attempt any two questions.**

5. Give the characteristics of troposphere. Why temperature decreases upwards in this sphere?
6. Why is CO considered a health hazard?
7. Where does ozone layer lie in atmosphere? How it is depleting and how we can prevent its depletion?



## Chapter 15: Water

## Chapter Wise Self Test 7

Time: 15 min

Total Marks: 12

(Objectives)

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Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Water molecule has a structure:  
(A) Ionic (B) non polar (C) Tetra hedral (D) Polar
- Nature of water is:  
(A) polar (B) non-polar (C) acidic (D) basic
- Temporary hardness is removed by adding:  
(A) quick lime (B) slaked lime (C) lime stone (D) sodium chloride
- The removal of  $Mg^{+2}$  and  $Ca^{+2}$  ions which are responsible for the hardness of water is called:  
(A) temporary hardness (B) permanent hardness  
(C) water softening (D) hydrogen bonding
- The process of removing temporary hardness of water is:  
(A) Clark's method (B) Washig soda method  
(C) Sodium zeolite (D) Filtration method
- Which salt makes water permanently hard?  
(A)  $Na_2CO_3$  (B)  $NaHCO_3$  (C)  $Na_2CO_2$  (D)  $CaSO_4$
- Rapid growth of algae in water is because of detargents having:  
(A) Sulphate salts (B) Phosphate salts (C) Carbonate salts (D) Sulphonic salts
- Which gas is used to destroy harmful bacteria in water?  
(A) iodine (B) chlorine (C) fluorine (D) bromine
- A disease that causes bone and tooth damage:  
(A) Fluorosis (B) Hepatitis (C) Cholera (D) Jaundice
- Vibrios Cholerae bacteria cause the disease:  
(A) Typhoid (B) hepatitis (C) Dysentery (D) Cholera
- Which one of the following disease causes liver inflammation?  
(A) typhoid (B) jaundice (C) cholera (D) hepatitis
- Which one of the following diseases causes severe diarrhea and can be fatal?  
(A) Jaundice (B) Cholera (C) Fluorosis (D) Typhoid



Marks: 48

(Subjective)

Time: 1:45 minute

## Part - I

Write short answers to any Five (5) questions:

[5x2=10]

2.
  - (i) Which forces are responsible for dissolving polar substances in water?
  - (ii) Why the water molecule is polar?
  - (iii) Write two disadvantages of hard water.
  - (iv) What is hardness?
  - (v) Give a method to remove permanent hardness of water.
  - (vi) How Sodium Zeolite softens water?
  - (vii) Which forces are responsible for dissolving polar substances in water?
  - (viii) Why non-polar compounds are insoluble in water?

3. Write short answers to any Five (5) questions:

[5x2=10]

- (i) Describe briefly the two types of Hardness of Water.
- (ii) How does lime stone dissolve in water?
- (iii) How is temporary hardness removed by Boiling of water?
- (iv) How water dissolves Sugar and Alcohols?
- (v) Define Scum and leaching Process.
- (vi) How water dissolves sugar and alcohols?
- (vii) Why pesticides are used?
- (viii) How detergents make the water unfit for aquatic life?

4. Write short answers to any Five (5) questions:

[5x2=10]

- (i) State effects of water pollution.
- (ii) Define industrial effluents.
- (iii) Why are Pesticides used?
- (iv) How do detergents affect the aquatic life?
- (v) What are the reasons of water borne diseases?
- (vi) What is meant by dysentery? How it caused?
- (vii) What do you mean by chlorination?
- (viii) What is the reason of jaundice and typhoid?

## Part - II

[9x2=18]

NOTE:- Attempt any two questions.

5.
  - (a) How polarity of water molecule plays its role to dissolve the substances?
  - (b) Explain the water pollution because of industrial waste.
6.
  - (a) Explain agricultural effluents are fatal for aquatic life.
  - (b) What is water pollution? Describe the effects of using polluted water.
7.
  - (a) Give some disadvantages of hard water.
  - (b) Explain the reasons, water is considered a universal solvent.



## Chapter Wise Self Test

8

## Chapter 16:

## Chemical Industries

Time: 15 mint

Total Marks: 12

(Objectives)

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Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen Ink. Cutting or filling two or more circles will result in zero mark in that question.

- Matte is a mixture of:
  - FeS and CuS
  - $Cu_2O$  and FeO
  - $Cu_2S$  and FeS
  - CuS and FeO
- The impurities associated with the minerals are known as:
  - metallurgy
  - ores
  - gangue
  - compounds
- Chalco-pyrite is an ore of:
  - Copper
  - Silver
  - Iron
  - Aluminium
- Which is the slag of Copper metallurgy?
  - $SiO_2$
  - $FeSiO_3$
  - CaO
  - $CaSiO_3$
- When  $NaHCO_3$  is heated, it forms:
  - $CO_2$
  - $Ca(OH)_2$
  - $CaCO_3$
  - CaO
- When  $CO_2$  is passed through the ammoniacal brine. The only salt that precipitates is:
  - $NaHCO_3$
  - $NH_4HCO_3$
  - $Na_2CO_3$
  - $(NH_4)_2CO_3$
- Percentage of nitrogen in urea is:
  - 76.6%
  - 66.6%
  - 56.6%
  - 46.6%
- In Haber's process the catalyst used is:
  - nickel
  - platinum
  - cadmium
  - Iron
- Used for the reduction of  $N_x$  pollutant in automobile systems.
  - Sodium Carbonate
  - Urea
  - Ammonium carbamate
  - Calcium carbonate
- Froth flotation process is used to concentrate the ore on.
  - Density basis
  - Concentration basis
  - Wetting basis
  - Magnetic basis
- Concentration of the copper ore is carried out by.
  - Calcination
  - Roasting
  - Froth flotation
  - Distillation
- In solvay's process slaked lime is used to.
  - Prepare  $CO_2$
  - Prepare quick lime
  - Recover ammonia
  - Form  $Na_2CO_3$



Marks: 48

(Subjective)

Time: 1:45 minute

**Part - I****Write short answers to any Five (5) questions:****[5x2=10]**

2. (i) What is the role of pine oil in the froth flotation process?
- (ii) Write electromagnetic separation process.
- (iii) How extraction of metal takes place from the concentrated ore?
- (iv) Explain the process of electro-refining.
- (v) Write a short note on gravity separation in metallurgy.
- (vi) Define ores. Write names of any two ores of copper.
- (vii) Name the various metallurgical operations.
- (viii) Explain process of electro-refining.

**Write short answers to any Five (5) questions:****[5x2=10]**

3. (i) What is blister copper?
- (ii) What is meant by Bessemerization?
- (iii) What is difference between slag and matte?
- (iv) Define minerals and gangue.
- (v) Give Formulae of chalcopyrite and copper glance.
- (vi) Which raw materials are required in Solvay's process?
- (vii) How ammonia is recovered in Solvay's process?
- (viii) What happens when  $CO_2$  is passed through Ammonical brine?

**Write short answers to any Five (5) questions:****[5x2=10]**

4. (i) Which raw materials are used in the preparation of urea?
- (ii) How is ammonia prepared for the Synthesis of urea?
- (iii) What is the percentage of nitrogen in urea? Also write down the formulae of urea.
- (iv) Describe the process of granulation of urea.
- (v) What are advantages of solvay's process?
- (vi) How  $NaHCO_3$  is converted to  $Na_2CO_3$ ?
- (vii) Write two important uses of urea.
- (viii) How Urea is prepared from Ammonium Carbamate? Write chemical equation also.

**Part - II****[9x2=18]****NOTE:- Attempt any two questions.**

5. Explain the process of roasting with reference to copper.

6. Write a note on smelting and bassemerization.

7. How urea is manufactured? Explain showing the flow sheet diagram.



## Chapter Wise Self Test

9

## Chapter 9 to 12:

first half book

Time: 15 mint

Total Marks: 12

(Objectives)

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Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- In an Irreversible Reaction, Dynamic Equilibrium:**
  - Never Establishes
  - Establishes Readily
  - Establishes after the completion of Reaction
  - Establishes before the completion
- $2H_{2(g)} + O_{2(g)} \xrightarrow[\Delta]{P} 2H_2O_{(g)}$  this reaction is an example of:
  - Reversible
  - Forward
  - Reverse
  - Irreversible
- Specific rate constant for forward reaction is represented by:**
  - $K_f$
  - $K_c$
  - $K_r$
  - $K_b$
- Which one of the following statements is not correct about active mass?**
  - A rate of reaction is directly proportional to active mass
  - Active mass is taken in molar concentrations
  - Active mass is represented by square brackets
  - Active mass means total mass of substances
- The conjugate acid of  $HPO_4^{2-}$  is:**
  - $H_2PO_4^{-1}$
  - $H_2PO_4^{-2}$
  - $PO_4^{-3}$
  - $H_3PO_4$
- Acid is a substance that gives Hydrogen ion in aqueous solution.**
  - Davy
  - Bronsted Lowery
  - Arrhenius
  - Lewis
- Which acid causes the acidity of stomach:**
  - Sulphuric acid
  - Hydrochloric acid
  - Nitric acid
  - Oxalic
- Open chain compounds also called:**
  - Aliphatic
  - Cyclic
  - Covalent
  - Ionic
- In which of the following groups, oxygen is attached on both sides with carbon atoms?**
  - ketone
  - ether
  - aldehyde
  - ester
- Substitution Reaction is the characteristic property of:**
  - Alkanes
  - Akenes
  - Alkynes
  - None of these
- Oxidation of Ethene with  $KMnO_4$  Produces:**
  - Oxalic acid
  - Glyoxal
  - Ethane glycol
  - Propene glycol
- The End Product of Oxidation of Acetylene is:**
  - Oxalic Acid
  - Glycol
  - Glyoxal
  - Potassium Hydroxide



Marks: 48

(Subjective)

Time: 1:45 minute

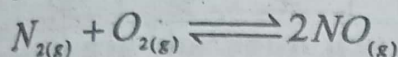
**Part - I****Write short answers to any Five (5) questions:****[5x2=10]**

Why at equilibrium state reaction does not stop?

Define chemical equilibrium state.

Complete the following equations: a)  $\text{CaCO}_3 \rightleftharpoons$  b)  $\text{H}_2 + \text{I}_2 \rightleftharpoons$ 

Write the equilibrium Constant expression for the following reaction



What is relationship between active mass and rate of reaction?

How can you know that a reaction has achieved an equilibrium state?

Define adduct.

Prove that water is an amphoteric specie.

**Write short answers to any Five (5) questions:****[5x2=10]**Why  $\text{BF}_3$  acts as Lewis acid and;  $\text{NH}_3$  as Lewis base.Write Conjugate acid of each of the following:- i.  $\text{NH}_3$  ii.  $\text{HCO}_3^{-1}$ 

Write uses of Sodium Hydroxide and Potassium Hydroxide.

Write down formulas of the following.

(a) Nitric acid

(b) Phosphoric acid

(c) Calcium Hydroxide

(d) Aluminium Hydroxide

A solution of HCl is 0.01M. What is its pH value?

How soluble salt recovered from water?

What are Aromatic Compounds? Give an example.

What is the difference between n-propyle and isopropyle? Explain with structure.

**Write short answers to any Five (5) questions:****[5x2=10]**

Write down the structural formulae of acetone and trimethylamine.

What is an ester group? Write down the formula of ethyl acetate.

Define Unsaturated Hydrocarbons with general formula.

What is combustion? Give a reaction.

What happens when ethyl alcohol is heated in the presence of  $\text{H}_2\text{SO}_4$ ?

How Halogenation take place in Alkenes? Give its chemical equation.

Write the equation for the conversion of oil into ghee.

Complete the given Reaction:  $\text{H}_2\text{C}=\text{CH}_2 + 2\text{Br}_2 \longrightarrow ?$ **Part - II****[9x2=18]****NOTE:- Attempt any two questions.**

(a) State the law of Mass Action and derive the expression for equilibrium constant for a general reaction.

(b) What is the importance of equilibrium constant?

(a) Explain with examples that how soluble salts are prepared?

(b) A solution of Hydrochloric acid is 0.01M. What is its pH value?

(a) Write a detailed note on classification of organic compounds.

(b) Explain the oxidation of acetylene.



## Chapter Wise Self Test 10 Chapter 13 to 16: second half book

Total Marks: 12

(Objectives)

Time: 15 mint

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| 1 | (A) | (B) | (C) | (D) | 7  | (A) | (B) | (C) | (D) |
| 2 | (A) | (B) | (C) | (D) | 8  | (A) | (B) | (C) | (D) |
| 3 | (A) | (B) | (C) | (D) | 9  | (A) | (B) | (C) | (D) |
| 4 | (A) | (B) | (C) | (D) | 10 | (A) | (B) | (C) | (D) |
| 5 | (A) | (B) | (C) | (D) | 11 | (A) | (B) | (C) | (D) |
| 6 | (A) | (B) | (C) | (D) | 12 | (A) | (B) | (C) | (D) |

**Note:** Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Which is reducing sugar?  
(A) Glucose (B) Maltose (C) Sucrose (D) Starch
- The organic compounds used as drugs to control bleeding are:  
(A) Vitamins (B) Proteins (C) Lipids (D) Glycerides
- Enzymes are proteins, which one the following properties they do not have?  
(A) They catalyze reaction (B) They are not specific  
(C) They are highly efficient (D) They are produced by living cells
- Which one of following is a triglyceride?  
(a) Carbohydrates (b) Proteins  
(c) Lipids (d) Vitamins
- A strange bitter smell noticed near photo copier machine is of:  
(A)  $H_2S$  (B)  $SO_2$  (C)  $O_3$  (D)  $O_2$
- Which one is not a green house effect:  
(A) Increasing atmospheric temperature (B) Increasing food chains  
(C) Increasing flood risks (D) Increasing sea-level
- The pH value of acid rain is:  
(A) 6 (B) 6.5 (C) 8 (D) 4
- Which one of the following is not a Greenhouse effects?  
(a) increasing atmospheric temperature (b) increasing food chains  
(c) increasing flood risks (d) increasing sea-level
- Temporary hardness is removed by adding:  
(A) quick lime (B) slaked lime (C) lime stone (D) sodium chloride
- Swimming pools are cleaned by a process:  
(A) Hydrogenation (B) Bromination (C) Chlorination (D) Nitration
- In the lime kiln the reaction goes to completion because of:  
(A)  $CaO$  is more stable than  $CaCO_3$  (B)  $CaO$  is not dissociated  
(C) Low temperature (D)  $CO_2$  escapes continuously
- Used for the reduction of  $N_x$  pollutant in automobile systems.  
(A) Sodium Carbonate (B) Urea  
(C) Ammonium carbamate (D) Calcium carbonate



## Part - I

**Write short answers to any Five (5) questions:**

[5x2=10]

- (i) Give the characteristics of polysaccharides.
- (ii) Write structural formula of glucose.
- (iii) What is difference between ghee and oil?
- (iv) Name two fatty acids with their formulae.
- (v) Write the general formula of triglycerides.
- (vi) How proteins are formed from amino acids? Give equation.
- (vii) Why is the temperature of upper stratosphere is higher?
- (viii) Define green house effect and global warming.

**Write short answers to any Five (5) questions:**

[5x2=10]

- (i) Why acid rain damages buildings?
- (ii) Ozone is beneficial for human life, justify.
- (iii) State the major sources of CO and CO<sub>2</sub> emissions.
- (iv) How ozone layer is being depleted by chlorofluorocarbons?
- (v) How water dissolves Sugar and Alcohols?
- (vi) What are the causes of hardness of water?
- (vii) How is temporary hardness removed by Boiling of water?
- (viii) What do you mean by chlorination?

**Write short answers to any Five (5) questions:**

[5x2=10]

- (i) Explain the chemistry of removing hardness of water by Clark's method.
- (ii) Define Scum and leaching Process.
- (iii) Write electromagnetic separation process.
- (iv) Write a short note on gravity separation in metallurgy.
- (v) What is meant by Bessemerization?
- (vi) Give Formulae of chalcocopyrite and copper glance.
- (vii) How carbonation of ammoniacal brine is carried out in Solvay's process?
- (viii) How is ammonia prepared for the Synthesis of urea?

**NOTE:- Attempt any two questions.**

[9x2=18]

5. (a) What type of reactions are given by alkanes? Explain with reference to halogenations of alkanes.
- (b) Explain the oxidation of acetylene.
6. (a) Give the characteristics of troposphere. Why temperature decreases upwards in this sphere?
- (b) Why is CO considered a health hazard?
7. (a) Give some disadvantages of hard water.
- (b) How urea is manufactured? Explain showing the flow sheet diagram.



## Chapter Wise Self Test 11

Time: 15 min

Total Marks: 12

(Objectives)

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Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- The water of crystallization is responsible for the:
  - Melting points of crystals
  - Boiling points of crystals
  - Shapes of crystals
  - Transition point of crystals
- Which one of the following salts makes the water permanently hard:
  - $\text{NaHCO}_3$
  - $\text{Na}_2\text{CO}_3$
  - $\text{Ca}(\text{HCO}_3)_2$
  - $\text{CaSO}_4$
- Which vitamin is fat soluble:
  - C
  - K
  - B
  - B Complex
- A reverse reaction is one:
  - Which proceeds from left to right
  - in which reactants react to form product
  - Which slows down gradually
  - Which speeds up gradually
- Formula of palmitic acid is:
  - $\text{C}_{17}\text{H}_{35}\text{COOH}$
  - $\text{C}_{15}\text{H}_{32}\text{COOH}$
  - $\text{C}_{16}\text{H}_{31}\text{COOH}$
  - $\text{C}_{13}\text{H}_{27}\text{COOH}$
- Which one of the following is not a fraction of petroleum:
  - Petrol
  - Alcohol
  - Diesel oil
  - Kerosene oil
- Lactic acid is found in:
  - Apple
  - Sour milk
  - Urine
  - Lemon
- Wood contains carbon about:
  - 40%
  - 50%
  - 60%
  - 70%
- The reduction of alkyl halides takes place in the presence of:
  - Mg / HCl
  - Cu / HCl
  - Na / HCl
  - Zn / HCl
- Which one of the following disease causes severe diarrhea and can be fatal:
  - Typhoid
  - Dysentery
  - Cholera
  - Jaundice
- The unit of molar concentration is:
  - $\text{mol dm}^{-3}$
  - $\text{mol dm}^{-2}$
  - $\text{mol dm}^{-1}$
  - $\text{mol}^{-1} \text{dm}^{-1}$
- Which is secondary pollutant:
  - $\text{H}_2\text{SO}_4$
  - $\text{CO}_2$
  - CO
  - $\text{SO}_3$



## Part - I

2. Write short answers to any Five (5) questions:

- (i) What is meant by the term "Chemical equilibrium state"?  $5 \times 2 = 10$
- (ii) Define irreversible reaction, give an example.
- (iii) What do you mean by the extent of reaction?
- (iv) Write down two macroscopic characteristics of forward reaction.
- (v) Why  $H^+$  ion acts as a Lewis acid?
- (vi) Define pH. What is the pH of pure water?
- (vii) Write the name and formula of two mineral acids.
- (viii) Differentiate between conjugate acid and conjugate base.

3. Write short answers to any Five (5) questions:

- (i) What is meant by isomerism?  $5 \times 2 = 10$
- (ii) What is an ester group? Write down the formula of ethyl acetate.
- (iii) Write any two uses of organic compounds.
- (iv) Why are the alkenes called olefins?
- (v) Differentiate between saturated and unsaturated hydrocarbons.
- (vi) Write two characteristics of monosaccharides.
- (vii) Write two points of importance of vitamins.
- (viii) What is the function of DNA?

4. Write short answers to any Five (5) questions:

- (i) Write down the name of stratosphere's regions.  $5 \times 2 = 10$
- (ii) Write down two effects of  $SO_2$ .
- (iii) Differentiate between primary and secondary air pollutants.
- (iv) What is jaundice? Give its symptoms.
- (v) Write down two properties of water.
- (vi) What is meant by minerals?
- (vii) How is ammonia prepared for the synthesis of urea?
- (viii) Write down the two uses of petroleum ether.

## Part - II

Note: Attempt any Two questions.

[ $9 \times 2 = 18$ ]

5.
  - (a) How the direction of a reaction can be predicted by the numeric value of equilibrium constant?
  - (b) Write the concept of Bronsted Lowry about acids and bases. Give examples.
6.
  - (a) Write any five uses of ethene.
  - (b) Explain any four sources of lipids.
7.
  - (a) Write down five advantages of Solvay's Process.
  - (b) Describe two methods for the removal of permanent hardness of water.



## Chapter Wise Self Test

12

(Objectives)

Time: 15 min

Total Marks: 12

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Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Lactic acid is present in:  
(A) Lemon (B) Orange (C) Apple (D) Sour milk
- Rapid growth of algae in water bodies is because of detergent having:  
(A) Sulphate salts (B) Phosphate salts  
(C) Sulphonic acid salts (D) Carbonate salts
- Thousands of amino acids polymerize to form:  
(A) Vitamins (B) Carbohydrates (C) Proteins (D) Lipids
- In the lime kiln the reaction goes to completion because of:  
(A)  $\text{CaO}$  is more stable than  $\text{CaCO}_3$  (B)  $\text{CaO}$  is not dissociated  
(C) Low temperature (D)  $\text{CO}_2$  escapes continuously
- The most important oligosaccharide is:  
(A) Glucose (B) Sucrose (C) Maltose (D) Fructose
- When  $\text{NaHCO}_3$  is heated it forms:  
(A)  $\text{CaO}$  (B)  $\text{CaCO}_3$  (C)  $\text{CO}_2$  (D)  $\text{Ca(OH)}_2$
- If the value of pH solution is less than seven it will be:  
(A) A base (B) An alkali (C) An acid (D) A neutral solution
- Pitch is black residue of:  
(A) Coal gas (B) Coke (C) Coal tar (D) Coal
- Dehydration of alcohols can be carried out with:  
(A)  $\text{HCl}$  (B)  $\text{H}_2\text{SO}_4$  (C)  $\text{KOH}$  (D)  $\text{NaOH}$
- Which one of the following ion causes out with:  
(A)  $\text{Mg}^{2+}$  (B)  $\text{Al}^{3+}$  (C)  $\text{Na}^+$  (D)  $\text{Fe}^{2+}$
- The colour of hydrogen iodide (H.I) is:  
(A) Black (B) Purple (C) Colourless (D) Blue
- The density of water at  $4^\circ\text{C}$  is:  
(A)  $1\text{ gm cm}^{-3}$  (B)  $2\text{ gm cm}^{-3}$  (C)  $3\text{ gm cm}^{-3}$  (D)  $4\text{ gm cm}^{-3}$



Marks: 48

(Subjective)

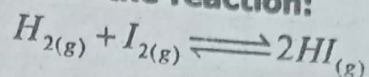
Chemistry - 10

Time: 2:45 minute

## Part - I

2. Write short answers to any Five (5) questions:

- (i) Define forward and reverse reaction.
- (ii) What do you mean by equilibrium constant?
- (iii) Write the equilibrium constant expression for the reaction:

 $5 \times 2 = 10$ 

- (iv) What is dynamic equilibrium state?
- (v) Write limitation of Arrhenius concept.
- (vi) Write any two physical properties of bases.
- (vii) Define neutralization reaction. Give an example.
- (viii) What are mixed salts? Give an example.

3. Write short answers to any Five (5) questions:

- (i) Write down different types of coal.
- (ii) What is isomerism? Give an example.
- (iii) What are structural formula? Give an example.
- (iv) What are closed chain hydrocarbons? Give an example.
- (v) Why are alkenes reactive?
- (vi) Name two diseases caused by deficiency of vitamin A.
- (vii) Where are protein found?
- (viii) What is difference between glucose and fructose?

 $5 \times 2 = 10$ 

4. Write short answers to any Five (5) questions:

- (i) Write the name of two primary air pollutants.
- (ii) Write two effects of ozone depletion.
- (iii) What is the temperature range of stratosphere and mesosphere?
- (iv) What is the reason of jaundice and typhoid?
- (v) Write two disadvantages of hard water.
- (vi) Name any two processes which involved in metallurgy for extraction of a metal in the pure state from its ore.
- (vii) Write the formulae of matte and urea.
- (viii) Write two advantages of Solvay's Process.

 $5 \times 2 = 10$ 

## Part - II

Note: Attempt any Two questions.

 $[9 \times 2 = 18]$ 

- (a) State the Law of Mass Action and derive equilibrium constant expression for general reaction.
- (b) Explain the Lewis concept of acids and bases.
- (a) Write down the uses of acetylene.
- (b) Write down the sources and diseases due to deficiency of some fat soluble vitamins.
- (a) Explain the process of smelting with reference to copper.
- (b) Write two methods for the removal of permanent hardness of water.



## Chapter Wise Self Test 13

Time: 15 min

Total Marks: 12

(Objectives)

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Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Which gas protects the earth from ultraviolet radiations?  
(A)  $CO_2$  (B)  $SO_2$  (C)  $NO_x$  (D)  $O_3$
- Pentahydroxy aldehyde is also called as:  
(A) glucose (B) fructose (C) starch (D) sucrose
- Which one of the following diseases causes severe diarrhea and can be fatal?  
(A) Jaudice (B) dysentary (C) cholera (D) typhoid
- Deficiency of vitamin-D causes \_\_\_\_\_ disease.  
(A) night blindness (B) rickets  
(C) eye inflammation (D) hepatitis
- Which one of the following gases is used to destroy harmful bacteria in water?  
(A) Iodine (B) chlorine (C) fluorine (D) bromine
- Matte is a mixture of:  
(A)  $FeS$  and  $CuS$  (B)  $Cu_2O$  and  $FeO$   
(C)  $Cu_2S$  and  $FeS$  (D)  $CuS$  and  $FeO$
- The reduction of alkyl halides takes place in the presence of:  
(A)  $Zn/HCl$  (B)  $Na/HCl$  (C)  $Mg/HCl$  (D)  $Cu/HCl$
- The natural source of formic acid is:  
(A) citrus fruits (B) sour milk (C) stings of bees (D) rancid butter
- Reactions which have comparable amount of reactants and products at equilibrium state have:  
(A) very small  $K_c$  value (B) very large  $K_c$  value  
(C) moderate  $K_c$  value (D)  $K_c = 0$
- For a reaction between  $PCl_3$  and  $Cl_2$  to form  $PCl_5$ , the units of  $K_c$  are:  
(A)  $mol\ dm^{-3}$  (B)  $mol^{-1}\ dm^{-3}$  (C)  $mol^{-1}\ dm^3$  (D)  $mol\ dm^3$
- Which one of the following is a Lewis base?  
(A)  $NH_3$  (B)  $BF_3$  (C)  $H^+$  (D)  $AlCl_3$
- General formula of alkane is:  
(A)  $C_nH_{2n+2}$  (B)  $C_nH_{2n-2}$  (C)  $C_nH_{2n+1}$  (D)  $C_nH_{2n}$



Marks: 48

(Subjective)

Chemistry - 10

Time: 1:45 Hours

**Part - I**

2. Write short answers to any Five (5) questions:  $5 \times 2 = 10$
- (i) How direction of reaction can be predicted?
  - (ii) What is irreversible reaction? Write one characteristic of it.
  - (iii) What is meant by active mass? Also write its unit.
  - (iv) Write two characteristics of reversible reaction.
  - (v) Write two examples of Lewis acid.
  - (vi) Write two examples of Lewis base.
  - (vii) Write two examples of mineral acids.
  - (viii) What is the source of the following? i. Citric acid    ii. Lactic acid
3. Write short answers to any Five (5) questions:  $5 \times 2 = 10$
- (i) Define heterocyclic compounds with an example.
  - (ii) Give two uses of organic compounds.
  - (iii) Define functional group with an example.
  - (iv) Define saturated hydrocarbons. Write their general formula.
  - (v) Give two physical properties of alkynes.
  - (vi) Write two properties of monosaccharides.
  - (vii) What is the difference between oil and ghee?
  - (viii) Write the sources and uses of vitamin-D.
4. Write short answers to any Five (5) questions:  $5 \times 2 = 10$
- (i) Write down two harmful effects of  $SO_2$ .
  - (ii) Write down the names of two secondary pollutants.
  - (iii) Why is it advised to switch off coal or gas heater before going to sleep?
  - (iv) Write two physical properties of water.
  - (v) Write down the causes of hardness in water.
  - (vi) Write two fractions found in residual oil.
  - (vii) Define minerals.
  - (viii) Why a small amount of coke is used in smelting process?

**Part - II**

Note: Attempt any Two questions.

 $[9 \times 2 = 18]$ 

5. (a) Derive equilibrium constant expression for a general reversible chemical reaction.
6. (b) Write down uses of any four acids.
7. (a) Explain halogenation of alkanes.
8. (b) Define amino acids. Explain that "amino acids are building blocks proteins".
9. (a) What is urea? Write raw material and three steps for its preparation.
10. (b) Write four general properties of water.



## Chapter Wise Self Test 14

Full book

Total Marks: 12

(Objectives)

Time: 15 mint

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|---|---|---|---|
| A | B | C | D |
| A | B | C | D |
| A | B | C | D |
| A | B | C | D |
| A | B | C | D |
| A | B | C | D |

Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Number of amino acids in proteins is:  
(A) 1000 (B) less than 10,000 (C) more than 10000 (D) 2000
- The conjugate acid of  $HPO_4^{2-}$  is:  
(A)  $H_3PO_4$  (B)  $H_2PO_4^{2-}$  (C)  $H_2PO_4^-$  (D)  $PO_4^{3-}$
- Coal gas is mixture of:  
(A)  $CO, CH_4, CO_2$  (B)  $CO, H_2, CO_2$   
(C)  $CO, CH_4$  (D)  $CO, CH_4, H_2$
- Urea is a nitrogenous fertilizer. It consist of \_\_\_\_\_ % nitrogen.  
(A) 26.6 (B) 46.6 (C) 56.6 (D) 66.6
- Temporary hardness of water can be removed by adding.  
(A) lime stone (B) washing soda (C) slaked lime (D)  $NH_3$
- \_\_\_\_\_ gas is the cause of global warming.  
(A)  $SO_2$  gas (B)  $NO_2$  gas (C)  $O_2$  gas (D)  $CO_2$  gas
- The quantity of water fit for drinking on the earth is \_\_\_\_\_ %.  
(A) 0.2 (B) 0.4 (C) 0.5 (D) 0.6
- In the beginning the rate of reverse reaction is.  
(A) fast (B) very fast (C) moderate (D) negligile
- Which one of the following is a water soluble vitamin?  
(A) D (B) C (C) E (D) K
- A reaction between an acid and base produces.  
(A) salt and gas (B) salt and water  
(C) salt and acid (D) salt and base
- The substances formed during the chemical reaction are called:  
(A) products (B) reactants (C) radicals (D) elements
- About \_\_\_\_\_ % traces of acetylene are present in coal gas.  
(A) 0.06 (B) 0.07 (C) 0.08 (D) 0.09



Marks: 48

(Subjective)

Time: 1:45 Hours

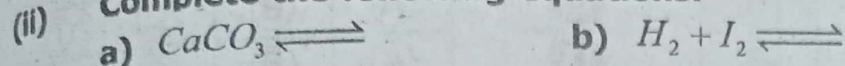
**Part - I**

2. Write short answers to any Five (5) questions:

 $5 \times 2 = 10$ 

(i) Define irreversible reaction. Give one example.

(ii) Complete the following equations:



(iv) What is equilibrium constant?

(v) What is meant by the extent of a reaction?

(vi) Why  $\text{BF}_3$  behaves as a lewis acid?

(vii) Write down two uses of nitric acid.

(viii) Define complex salts. Give one example.

(ix) Write down two uses of pH.

3. Write short answers to any Five (5) questions:

 $5 \times 2 = 10$ 

(i) Define condensed formula and give example.

(ii) Write names of four types of coal.

(iii) Write general formula of carboxyl group and give example.

(iv) Write the name and molecular formula of the simplest alkyne.

(v) Write two uses of Ethene.

(vi) Write two important usages of carbohydrates for our body.

(vii) Write the names of fat soluble vitamins.

(viii) What are the advantages of water soluble vitamins?

4. Write short answers to any Five (5) questions:

 $5 \times 2 = 10$ 

(i) What is troposphere and where does it exist in atmosphere?

(ii) What is meant by green house effect?

(iii) What are primary pollutants of air? Give an example.

(iv) What is difference between soft water and hard water?

(v) Write two effects of water pollution.

(vi) Write two methods for the prevention of waterborne diseases.

(vii) What is meant by gangue?

(viii) What is blister copper?

**Part - II**

Note: Attempt any Two questions.

 $[9 \times 2 = 18]$ 

5. (a) State the Law of Mass Action and derive the expression for equilibrium constant for a general reaction.

(b) Describe the uses of any four acids.

6. (a) Write down five sources of Alkanes.

(b) Explain the sources and uses of lipids.

7. (a) Write the five advantages of Solvay's process.

(b) Explain the methods to remove temporary hardness.



## Chapter Wise Self Test

15

Full book

Total Marks: 12

(Objectives)

Time: 15 mint

|   |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |

|     |     |     |     |
|-----|-----|-----|-----|
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |

|    |
|----|
| 7  |
| 8  |
| 9  |
| 10 |
| 11 |
| 12 |

|     |     |     |     |
|-----|-----|-----|-----|
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |
| (A) | (B) | (C) | (D) |

Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

- Swimming pools are cleaned by which process?  
(A) Nitration (B) Hydrogenation (C) Bromination (D) Chlorination
- Which disease causes bones and teeth damage?  
(A) Fluorosis (B) Hepatitis (C) Cholera (D) Joundice
- The fraction of residual oil is:  
(A) Petroleum gas (B) Petroleum ether  
(C) Diesel oil (D) Lubricants
- The colour of iodine is:  
(A) White (B) Red (C) Pink (D) Purple
- The units of molar concentration are:  
(A)  $\text{mol cm}^2$  (B)  $\text{mol dm}^3$  (C)  $\text{mol dm}^{-3}$  (D)  $\text{mol m}^2$
- The acid used for food preservation is:  
(A) Sulphuric acid (B) Nitric acid  
(C) Hydrochloric acid (D) Benzoic acid
- Sum of pH and pOH of solution at  $25^\circ\text{C}$  is always:  
(A) 14 (B) 12 (C) 10 (D) 8
- The first organic compound was prepared by:  
(A) Dalton (B) Berzelluis (C) Wohler (D) Lavoisier
- The general formula of alkenes is:  
(A)  $\text{C}_n\text{H}_{2n+2}$  (B)  $\text{C}_n\text{H}_{2n}$  (C)  $\text{C}_n\text{H}_{2n+1}$  (D)  $\text{C}_n\text{H}_{2n-2}$
- Which one of the following is tasteless compound?  
(A) Starch (B) Glucose (C) Fructose (D) Sucrose
- Which organic compounds are used as drug to control bleeding?  
(A) Vitamins (B) Glucose (C) Lipids (D) Proteins
- Just above the earth's surface is:  
(A) Mesosphere (B) Stratospher (C) Thermospher (D) Troppspher



Marks: 48

(Subjective)

Time: 1:45 minute

**Part - I**

2. Write short answers to any Five (5) questions:

5 × 2 = 10

- (i) Give two macroscopic characteristics of Reverse reaction.
- (ii) Derive equilibrium constant expression for the synthesis of nitrogen monoxide from  $N_2$  and  $O_2$ .
- (iii) How direction of a reaction can be predicted?
- (iv) Write two possibilities of chemical equilibrium state.
- (v) Write names of two naturally occurring acids with their sources.
- (vi) Give two uses of Magnesium hydroxide.
- (vii) Define normal salts with one example.
- (viii)  $Na_2SO_4$  is a natural salt. Write its uses.

3. Write short answers to any Five (5) questions:

5 × 2 = 10

- (i) Classify the organic compounds on the basis of skeleton.
- (ii) What is the process of destructive distillation.
- (iii) What is Isomerism?
- (iv) Define process of halogenation with an example.
- (v) Why alkenes are also known as olefins?
- (vi) What is meant by non essential amino acids?
- (vii) Define carbohydrates and write its general formula.
- (viii) What is meant by genetic code of life?

4. Write short answers to any Five (5) questions:

5 × 2 = 10

- (i) Differentiate between primary and secondary air pollutants.
- (ii) How ozone layer forms in stratosphere?
- (iii) State the phenomenon of decreasing temperature in troposphere.
- (iv) Why non-polar compounds are insoluble in water?
- (v) Differentiate between soft and hard water.
- (vi) Define gravity separation method.
- (vii) Describe the formation of petroleum.
- (viii) Write two uses of kerosene oil.

**Part - II**

Note: Attempt any Two questions.

[9 × 2 = 18]

5. (a) State the law of mass action and derive the expression for equilibrium constant for a general reaction.
- (b) Explain Lewis concept of acids and bases with the help of examples.
6. (a) Explain the halogenation of Methane in diffused and direct sunlight.
- (b) Describe the importance of vitamins.
7. (a) How is urea manufactured? Explain with the help of flow sheet diagram.
- (b) Explain the water pollution because of industrial waste.



## Key Chapter Wise Self Test - 1

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | D | 2 | B | 3 | C | 4  | A | 5  | B | 6  | D |
| 7 | A | 8 | C | 9 | B | 10 | C | 11 | C | 12 | C |

## Key Chapter Wise Self Test - 2

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | C | 2 | D | 3 | A | 4  | D | 5  | D | 6  | B |
| 7 | B | 8 | C | 9 | A | 10 | B | 11 | B | 12 | C |

## Key Chapter Wise Self Test - 3

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | B | 2 | D | 3 | D | 4  | D | 5  | A | 6  | B |
| 7 | A | 8 | A | 9 | B | 10 | D | 11 | B | 12 | B |

## Key Chapter Wise Self Test - 4

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | A | 2 | C | 3 | B | 4  | A | 5  | B | 6  | D |
| 7 | C | 8 | B | 9 | D | 10 | C | 11 | A | 12 | A |

## Key Chapter Wise Self Test - 5

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | D | 2 | A | 3 | A | 4  | B | 5  | B | 6  | A |
| 7 | A | 8 | A | 9 | D | 10 | B | 11 | C | 12 | C |

## Key Chapter Wise Self Test - 6

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | D | 2 | D | 3 | C | 4  | D | 5  | A | 6  | A |
| 7 | A | 8 | B | 9 | B | 10 | B | 11 | C | 12 | A |

## Key Chapter Wise Self Test - 7

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | D | 2 | A | 3 | B | 4  | C | 5  | A | 6  | D |
| 7 | B | 8 | B | 9 | A | 10 | D | 11 | D | 12 | B |

## Key Chapter Wise Self Test - 8

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | C | 2 | C | 3 | A | 4  | B | 5  | A | 6  | A |
| 7 | D | 8 | D | 9 | B | 10 | B | 11 | C | 12 | B |

## Key First Half Book Self Test - 9

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | A | 2 | D | 3 | A | 4  | D | 5  | B | 6  | C |
| 7 | B | 8 | A | 9 | B | 10 | A | 11 | C | 12 | A |

## Key Second Half Book Self Test - 10

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | A | 2 | B | 3 | B | 4  | C | 5  | C | 6  | B |
| 7 | B | 8 | C | 9 | B | 10 | C | 11 | D | 12 | B |

## Key Full Book Self Test - 11

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | C | 2 | D | 3 | B | 4  | D | 5  | D | 6  | B |
| 7 | B | 8 | A | 9 | D | 10 | C | 11 | A | 12 | A |

## Key Full Book Self Test - 12

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | D | 2 | B | 3 | C | 4  | D | 5  | B | 6  | C |
| 7 | C | 8 | C | 9 | C | 10 | B | 11 | C | 12 | A |

## Key Full Book Self Test - 13

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | D | 2 | A | 3 | C | 4  | B | 5  | B | 6  | A |
| 7 | A | 8 | B | 9 | C | 10 | C | 11 | A | 12 | A |

## Key Full Book Self Test - 14

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | C | 2 | B | 3 | D | 4  | B | 5  | C | 6  | D |
| 7 | A | 8 | D | 9 | C | 10 | B | 11 | A | 12 | A |

## Key Full Book Self Test - 15

|   |   |   |   |   |   |    |   |    |   |    |   |
|---|---|---|---|---|---|----|---|----|---|----|---|
| 1 | D | 2 | A | 3 | D | 4  | D | 5  | C | 6  | D |
| 7 | A | 8 | C | 9 | B | 10 | A | 11 | D | 12 | D |



# StudyNotes.pk

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- Books
- Notes
- Model Papers
- Guess Papers
- Past Papers
- Test Papers